AMERICAN MACHINIST

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Engine 451, New York Central and Hudson River Railroad.

In our issue of September 4th we gave a short account of a fast newspaper train on the above named railroad. Since that time we have had numerous inquiries as to the locomotive which drew the train. Through the courtesy of William Buchanan, Superintendent of Motive Power, we were furnished with the blue print from which the engraving was made, and with the details published herewith.

The locomotive is known as class A, their standard engine for passenger service, which has proved very successful in operation. Following are the most important dimensions:

GENERAL DIMENSIONS.

Cylinder	Diam. and stroke	17″×24″
"	Ports' length	15½″
"	" steam width	1¼″
"	" exhaust	2⅜″
Valves:		
"	Travel	5″
"	Outside lap	7/8″
"	Inside "	3-32″
"	Lead in full gear	1-16″
Exhaust nozzle	High single diam	4½″
" "	Height from base of stack	
Smoke-stack	Diam., internal	16″
Boiler	Diam. of smallest ring	50″
"	Length of barrel	10′ 2″
"	Height of wagon top	11′
" pressure	Per square inch	145 lbs.
Fire-box	Length outside	6′ 8 1-16″
"	Width "	43″
"	Depth inside	72½″
"	Size of grate	72 1-16″×35⅝″
"	Grate area, soft	17.87
Tubes	Number	198
"	External diam.	2′
"	Length between sheets	11′ 7″
Heating surface	Tubes	1,200
" "	Fire-box	153+
" "	Total	1,353+
Weight of engine	Working order	84,700
" "	Working order on truck	31,000
" "	Working order on drivers	53,700
Weight of tender	Loaded (maximum)	62,220
Capacity "	Water, gallons	2,800
" "	Coal, lbs	10,000
Weight of engine and tender		146,920

Engine tender fitted with air brake.

It will be remembered that this train made the run from Syracuse to Buffalo, a distance of 148 miles, at an average speed of 65.6 miles per hour, running for considerable distances at a speed of very nearly 75 miles per hour. It should also be noted that no special preparation of the engine was made for this run. In regard to this a Master Mechanic, S. S. White, at Syracuse, says: "No unusual preparation was made for the trip, and the engine before and since has made her regular daily trips."

The train was the usual "newspaper" train, consisting of one passenger coach and a baggage car.

In regard to the grade and curves, we have no data at hand, but from some knowledge of the road, should say that between the points named there is a slight up grade, with no curves of much consequence. The condition of the track and road bed are first class in every respect.

The fire box used with this locomotive is shown on page 2. It is the invention of Mr. Buchanan, and has been in use for some time with remarkably good success both as to economy of fuel and prevention of smoke from bituminous coal. As will be seen, the fire-box is divided into two compartments by a water table which crosses the box diagonally. The products of combustion must all pass through an elliptical opening in this table before reaching the tubes.

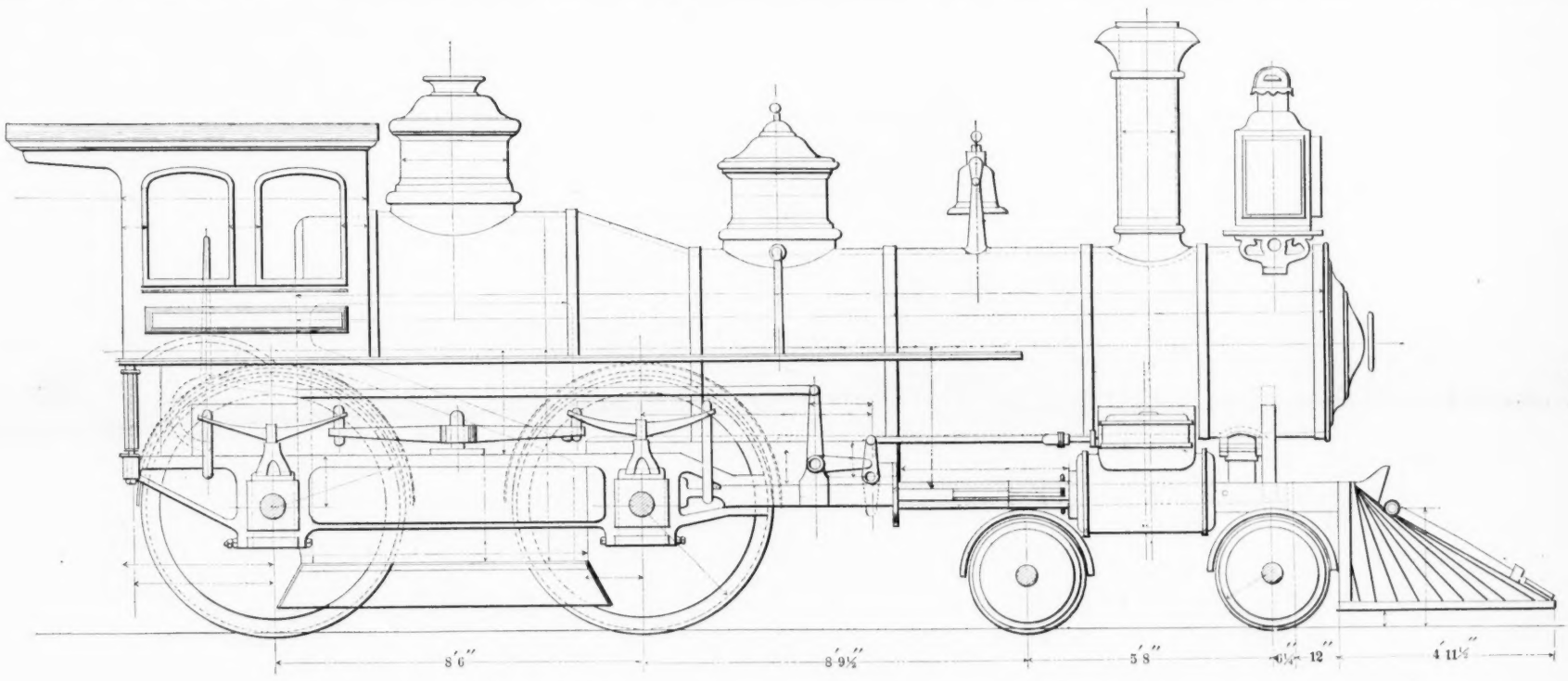
Steam is taken from the dome to a coil on the water table, where it is superheated. From the coil the superheated steam is taken to jets, placed in openings four at the front and the same number at the rear of the fire-box. These jets of steam, when in operation, induce strong currents of air through the openings, which strike the rising gases in such a way as to cause their thorough admixture with oxygen, and substantially complete combustion. A representative of the AMERICAN MACHINIST, a practical railroad man, wrote as follows of a trip some two years ago from New York to Albany on a locomotive having this fire-box, the train being the Chicago limited express, consisting of seven cars:

* * * * *

The coal on the tender was a soft, crumbly kind, and was badly slacked. Three-quarters of it would have passed through a riddle with one-inch meshes.

* * * * *

During the whole of the trip we paid very close attention to the firing, and watched keenly for sparks and smoke. In passing through the numerous tunnels and long bridges, we could see no sparks thrown, and in returning at night, when the engine was making up time, and was hammering along at 60 miles an hour, all the fire passing through the stack was an occasional spark that went high into the air and came down black. The best smoke-consuming locomotive we had ever seen in Europe—and we have been on engines that were considered nearly perfect in this respect—would make black smoke when steam was shut off after the engine had been working hard, but this locomotive showed no indication of smoke at such times. The fireman generally put in two or three shovelfuls of coal at a firing, and kept the fire level at a uniform depth. As he scattered coal over the fire, there would be a jet of smoke pass through the stack, but it cleared in an instant. When he raked the fire the same thing occurred, but the smoke did not last more than two or three seconds. While riding on the car, when the engine was working hard, we found there was no pelting of cinders on the roof, so common with fast-run trains. The engine has an extended front end, open stack, with bell-shaped base and a single exhaust nozzle 4½ inches diameter. We recommend people, who think that smoke cannot be prevented with locomotives burning bituminous coal, to obtain the means of watching this engine doing heavy work, and they will certainly be convinced to the contrary.



FAST LOCOMOTIVE NO. 451, OF THE NEW YORK CENTRAL RAILROAD.

Valves and Valve Motions—Working Under High Steam and High Speed.

BY W. H. HOFFMAN.

The working steam pressure is now keeping pace with high speed in marine engines, and is coming to the front for stationary purposes. High steam and high speed valve travel have always been combined in locomotive practice, and the practical limits in both directions have hardly been determined at this writing.

I think it safe to say that there has been five times the amount of experimenting done on valves and valve motions for marine engines as that done on locomotive work.

In the marine type of engine the pressures, until recently, have been less than 100 lbs. per inch, while the locomotive has carried from 110 lbs. to 150 lbs. for thirty years.

Of course, the conditions are different in these motors, but not to an extent that will prevent fair comparisons, as the leading features of construction are identical. The main difference is the conditions under which the valves work, and this difference appears only in one type of marine engines, viz., the plain condensing machines.

In the two cylinder compound and the triple expansion engines the initial and intermediate cylinder valves are moving under similar loads as those of a locomotive, for both work under high steam and back pressure, and both have rapid motions.

The locomotive designers have clung to the old slide valve as a rule, although we have examples of some bold members of the fraternity who have put in practical operation other valves with more or less success.

The writer has seen circular and piston valves applied to marine engines working under 110 lbs. of steam with success, but the average locomotive engineer will say that he would prefer to withhold his opinion when consulted as to the performance of either of these valves.

I examined the engines of the new North German Lloyds steamer Saale on her first trip to this country last month, and found a successful working piston valve attached to a 44″ initial cylinder, and working under a boiler pressure of 150 lbs.

This engine is of the triple expansion type—cylinders, 44″—70″ and 108″, 6 feet stroke, cranks at 120°—and it made on this voyage an average of 65 revolutions per minute, and will make after a months' run 68 revolutions per minute, and later 70 revolutions. On examination the valves showed an elegant surface, and every indication points to durability, as the lubrication is perfect and the pressure so distributed as to keep the valve in an equipoise and a true circular form. As to the parts in motion, I noticed a decided reduction in some of them, and for a land engine this cutting down of weight could be carried very much further, but, of course, it is not safe to take any chances as to strength on a sea-going ship.

The valve chests of a piston valve can always be fitted with a liner that is convenient to remove, and a piston, or even a circular valve of any form, can always be repaired with great accuracy by the ordinary machine tools. What is wanted in a valve working under high steam, is a short travel, multiple ports, and a low valve speed will reduce wear and tear, and at the same time permit of large openings. Although many engineers may disagree with me in this matter, I still believe that the locomotive will yet be fitted with some valve other than the *D* slide, and when the sizes of cylinders of the marine engine and the locomotive are compared, I confess I can see no reason why a change for the better should not be adopted. If the marine engineer can make a piston and circular valve 20″ in diameter (and even larger) practically tight, there certainly can be no reason why we cannot do as well on locomotives and stationary engines.

My experience has been that a large amount of the noise that comes from a noisy engine is due to over-weighted valve motions, and about one half of the high speed engines now running have too much weight in their valve gear. I speak of this, as many of them are troubled with a continuous heating of the eccentrics, and a heavy valve gear outside of the valve load will cause serious heating when under rapid vibrations.

One of the objects of the Joy and the Bryce-Douglas valve motions, is to reduce friction and shock, and they both accomplish a great deal in this direction.

I like any design of valve motion that can be made light, and see no reason why a great reduction cannot be made in any of them, excepting those having ugly overhanging details.

All valve gear designed for high speed engines should be made only after careful study, and the closest consideration of every moving part, no matter how slight the motion.

The pins and journals must have liberal wearing surfaces, and all bolt holes should be reamed. In a valve motion absolute security must be assured, to obtain satisfactory results, and this with the other requirements are not at present always met.

British Exports to the United States

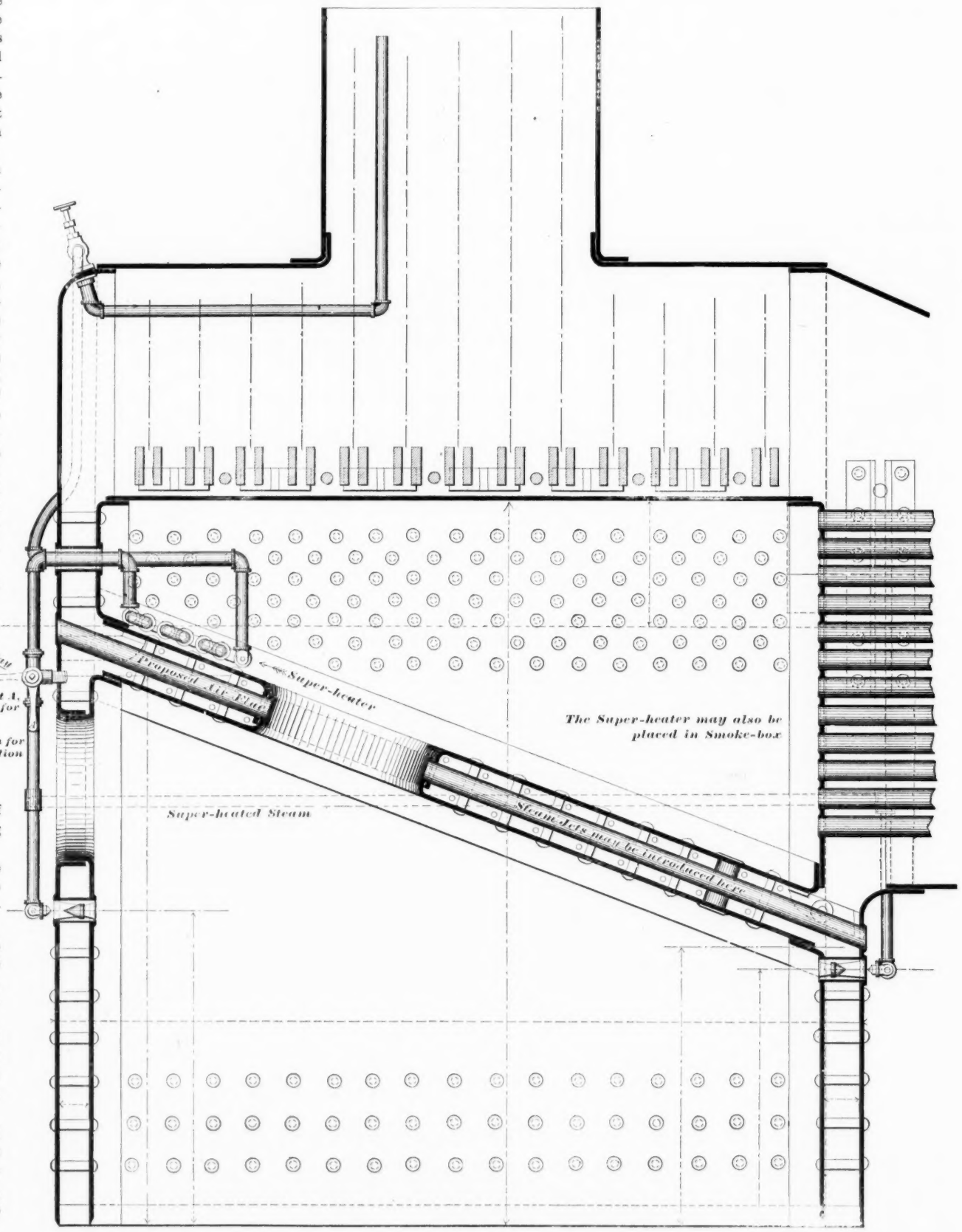
Our free trade friends are frequently troubled because we don't buy enough goods from abroad, especially from England. We copy below an editorial from the London *Ironmonger* of recent date, reviewing the British exports and imports for August. It must make free traders feel better:

The monthly returns of the Board of Trade for August are in some respects rather more favorable than some of the recent monthly returns from the same quarter. These statistics show that the imports last month were 27,321,355*l*., or 1,485,621*l*. less than in the same month last year. The decrease arose chiefly in respect of 'raw materials for sundry industries and manufactures,' and in articles of food and drink. In manufactured articles, on the other hand, there was a considerable increase. The aggregate value of the exports was 18,744,859*l*., or 250,226*l*. more than in August, 1885. The increase was largely in respect of yarns and textile fabrics, but also to some extent in metals and miscellaneous articles. The transit trade, or exports of foreign and colonial produce, increased by 1,293,599*l*. The total quantity of iron and steel exported was 299,238 tons, valued at 1,859,151*l*., as against 281,112 tons, worth 1,825,708*l*., in August, 1885. On going into the details we find an increase of about 14 per cent. in pig iron, entirely owing to the augmented purchases of the United States and British North America.

The quantity sent to the States was 26,897 tons, as against 7,149 tons in the same month of last year. In bar, angle, bolt, and rod iron there was a decrease equal to about 30 per cent., which arose principally with Germany, Italy, Turkey, the East Indies, and the minor countries. In railroad iron of all kinds there was a slight decrease, despite the better buying of Sweden and Norway, Egypt, the United States, British North America, Peru, South Africa, and Australasia, the falling off being mainly with Holland, Italy, Brazil, and the Argentine Republic. The figures given in the special return show that about 16,000 tons of railway materials other than rails were shipped during the last month. Of wire we sent off nearly 50 per cent. less, but in what directions is not set forth in detail. In hoops, sheets (including galvanized) boiler and armor plates, there was a falling off equal to about 6 per cent., chiefly with Germany, the United States, and Australasia, and in spite of the enlarged requirements of Russia, Italy, British North America, the East Indies, and the minor countries. In tin plates there was an augmentation equal to about 4 per cent., which was wholly due to the purchases on behalf of the United States. In cast or wrought "and all other manufactures unenumerated," there was an improvement equal to nearly 8 per cent., mainly with Spain, Brazil, British North America, Australasia, and the minor countries. In old iron for re-manufacture there was a marked expansion of business with the United States, and a net increase of about 3 per cent. In unwrought steel there was an expansion of business equal to about 300 per cent, chiefly with the United States, but also with the "other countries." In this respect France was not quite so good a buyer, and the quantity sent to the States obviously consisted largely of blooms. The exports of hardware and cutlery increased by £10,000, the best buyers being Germany, France, Spain, the United States, the foreign West Indies, Brazil, the Argentine Republic, British North America, the East Indies, and Australasia. In steam engines there was a considerable decrease, especially with Germany, Holland, Spain, South Africa, the East Indies, and Australasia. This was in spite of the better buying of Belgium, France, Italy, Egypt, the United States, Brazil, and British North America. In other descriptions of machinery and millwork there was a small diminution, owing to the lessened wants of Russia, Germany, Belgium, France, Italy, Brazil, and Australasia, and despite the larger purchases of Holland, Spain, Egypt, the United States (a large increase) British North America, South Africa, and the East Indies.

In copper, unwrought and wrought, as well as in mixed or yellow metal, there were decreases, whilst in lead and tin more was done.

In zinc or spelter there was a marked decrease, of which, with other details.


Three Way Cock
When handle is at A, the Cock is open for Steam Jets.
When at B, open for Water Circulation
Proposed Air Plate
Super-heater
The Super-heater may also be placed in Smoke-box
Super-heated Steam
Steam Jets may be introduced here

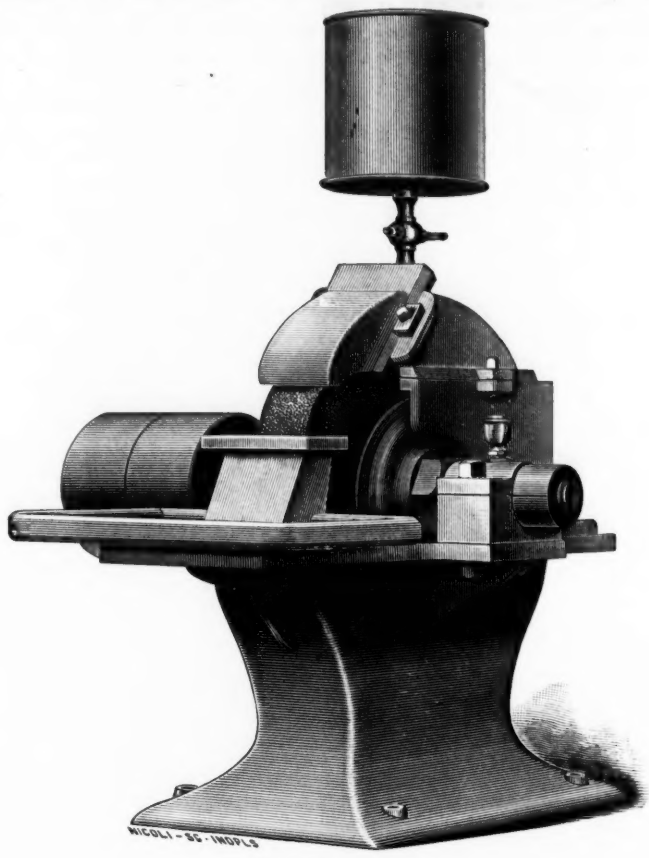
Buchanan's Fire Box. *See page* 1.

If we look at our large and successful machine shops we find that nearly all of them have grown up from small beginnings. This is so according to nature that it is hardly likely to change. There is truth in the assertion that modern machine shop practice favors the large shop, but launching forth a big enterprise presents many chances for miscalculation over growing up gradually and meeting the demands of that growth. Every day we hear of shop enlargement in the line of growing up from small beginnings; this will always be so, at least until machine shop practice reaches the condition of an exact science—something that will not occur until progress ceases.

Tool Grinder for Machinists' Tools.

The engraving shows the construction of this machine so fully that but little description is necessary. Following are some of the dimensions: Size of wheel, 12″x2″, with $1\frac{1}{4}$″ hole; size of pulleys, 6″x3″; length of bearings, 4″; number of revolutions per minute, 1,200; height of machine, 27″; weight, with wheel, 95 lbs.; bench room occupied, 20″x 20.″

The manufacturer is D. W. Williams, Indianapolis, Ind.



TOOL GRINDER.

Patterns for Cable Pulleys.

BY F. W. BARROWS.

These pulleys or sheaves are sometimes made in a three part flask when there is but a single groove, as in wheels for conveying power, where the wire or hemp cable takes the place of a flat belt.

There are some objections to this way of moulding sheaves, and the principal one is the necessarily fragile form it entails upon the pattern. Then the groove in some cases is very deep, which leaves a good deal of overhanging sand in the mould. As a rule I think it is better to form the groove by cores. This will make a more substantial pattern. There will also be less work for the moulder, and less risk of losing the casting by reason of the sand breaking away which is to form the groove.

It will be seen by Fig. 56 that a pattern made to form the groove in green sand, by means of a three part flask, would be a very weak affair. It could be made of iron, to be sure, but it is really of no advantage to make the pattern in this shape. I should make it with a core as follows:

Glue up the rim in cants or segments, putting in not less than three courses, and make the middle course (there should always be an odd number of courses in a pattern which is to have a set of arms in, or rather there should be a course in the right place and full thick enough to receive the arms, as it makes bad work where a part of two or three courses come within the thickness of the arms) full as thick as the arms if they are to be central, and after gluing on this course cut the arms in far enough across the rim to give them a good hold. The arms have already been glued together at the center and planed off flat and true. Get the arms out wide enough to make the fillet where they join the rim, as is shown by Fig. 57, where *a* is the rim, *b* the arm.

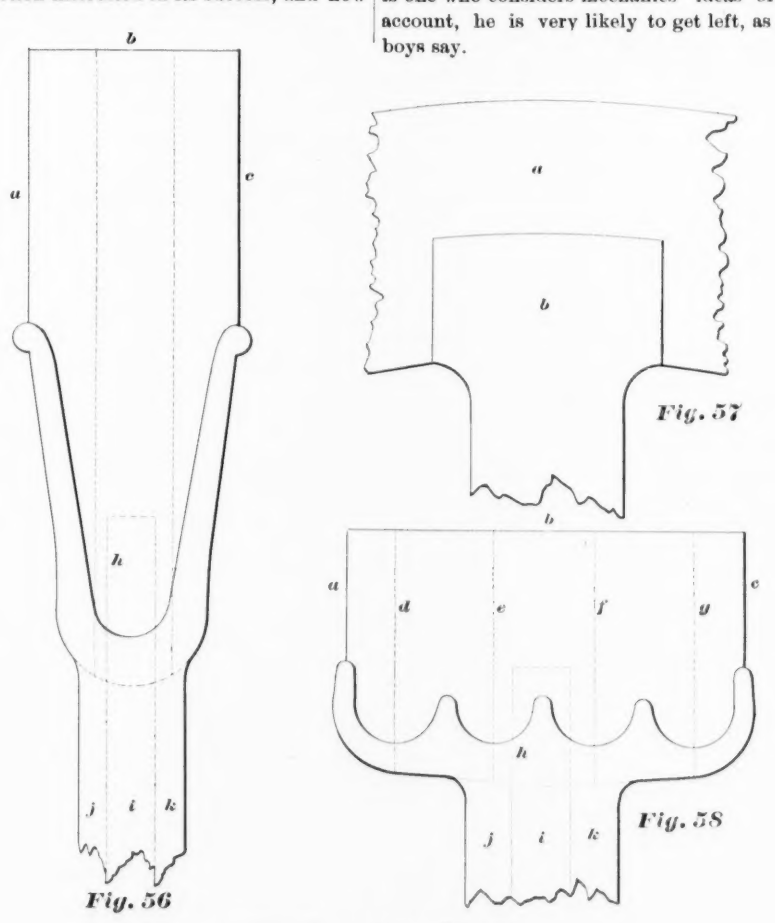
Before gluing the arms into rim it saves time and trouble to lay them out and work them to the finished shape, except where they join the rim. If they are to have ribs on each side, before fastening on the hubs place the hub on a flat surface and then fit the ribs up to them, holding the ribs on a radial line from center of hub. If the arms are tapered in thickness towards the rim you had best put the hub in its place, and fit the ribs against it on the spider. That portion of the rim which is included in the thickness of the arms must be turned up before putting them in.

After the arms are fastened in place put on the hubs and scribe around them so as to get the length of ribs. If the ribs were fitted against the hub, while on the spider, the position of each one as regards length could be located by a knife mark. After the ribs are fitted against the rim, fasten on the hubs, then the ribs. I would cut off the hub on one side even with the rim, making the remaining portion of it loose. This will give the moulder a chance to lay the pattern on a plain follow-board. The ribs on the same side of arms may also be made loose, though I should rather make them of such shape that they might be readily coped off in the mould.

The shape of core-box in section may be seen by Fig. 56, and the length of it will be made to suit your own and the moulders ideas, that is, if you consider the moulder's ideas on the subject of any account. If you don't, then look out for trouble when the pattern goes to the foundry.

You have very likely heard how easy it is to lead a horse to the brook, but it isn't so easy to make him drink if he don't wish to. The same difficulty is encountered in trying to make a moulder (or anybody else) do any work that he isn't, and doesn't wish to be, interested in the success of. There may be men who will honestly do their very best under such circumstances, but they are as scarce as hen's teeth.

The first move towards success in any undertaking is to get all who are to assist in its completion interested in its success, and how can this be done more easily, with the man who takes pride in knowing the whys and wherefores of his business (and mark you these are the men who are bound to succeed) than by asking for his ideas, on that portion of the work which is his specialty, and if there be no objection, letting him do it in his own way? In this way you ensure success, because, you see, you not only get the advantage of each one's skill, but you also, by leaving the manner of doing the work to his judgment, put him on his mettle, and he will do the very best he can. Many a casting which goes out into the back yard to be broken up, may trace its downfall back to the designer, who knows what he wants himself, or to the pattern maker who considers the moulder not as a mechanic but as a man who only knows how to shovel dirt. The designer or draftsman may not understand all the branches through which his work must pass before it is completed, and if he is one who considers mechanics' ideas of no account, he is very likely to get left, as the boys say.



PATTERNS FOR CABLE PULLEYS.

I think it best and cheapest to make the groove in this sheave by means of a core, but still if the moulder wanted to make it in green sand, and I couldn't convince him of the error of his way, I would make the pattern to suit him, because, you see, I should want the casting to be as perfect as possible. If the pattern is made to suit the moulder and then you get a poor casting you have him in a tight place.

If the moulder makes a success of the job in green sand, when you get a sheave to make like Fig. 58, you will be able to show him that he can also make a good sheave with cores, for I think any moulder will admit that it is best to make this four-grooved sheave with cores. After he has moulded it, and finds out how well it works, I presume he will acknowledge that a single groove may be made equally as well with cores.

The core prints for the two sheaves are shown by the lines *a b c*, in Figs. 56 and 58. The dotted lines in these two figures show the construction of patterns; *h* shows where the arm is cut into rim, *i* is the arm in each figure, and *j k* the ribs on either side.

The core-box for Fig. 56 had better be parted through the center of groove. For Fig. 58 make the ends of box fast to the bottom, which, with the ends, is made of the same thickness as core print between lines *a* and *c*. The sides are simply flat pieces, and are both loose, as there can be no draft. The outside at *b* is to be left open for both wheels.

Personal.

Mr. George A. Barnard, well known to most of our readers, who resigned his position with the Buckeye Engine Company last May, since which he has been on vacation for the first time in thirteen years, has now connected himself with the Hewes & Phillips Iron Works, of Newark, N. J., as general sales agent. He will attend to contracting for steam plants complete according to modern steam engineering practice. Mr. Barnard has a large circle of friends, all of whom know him as a gentleman of undoubted integrity and an engineer of high ability. As readers of the AMERICAN MACHINIST know, the Hewes & Phillips Iron Works have an excellent reputation for the machinery they build. We therefore feel confident in predicting satisfactory results of this new connection. Mr. Barnard's office is at 75 Temple Court, New York.

The brick manufacturers have just been holding a convention in Cincinnati. This is an ancient industry, but it appears to be much in the same condition that it was when Egyptians ran the principal brick yards and employed Hebrews to do the work. The *Clay Worker* says: "They [the manufacturers] have been brought into the sharpest competition in their business, to the extent that they have been compelled to reduce the compensation of their employes to the very lowest scale possible to live. The task-master has been compelled to add grievous burdens to the labor of those employed."

Brick machinery has been in use for many years, but until lately it has not been very widely adopted.

The *Jewelers' Journal* of Chicago says: "The jewelry trade of the West, and, as this section of the country almost invariably of late years has given the impulse upward or downward to all important markets, we may safely say that the jewelry trade of the country, has come through the summer months to the first of September with better results than have been realized for several years."

The sum of $75,000 was appropriated at the last session of Congress for the purpose of experimenting with torpedoes. It is expected that inventors of torpedoes will soon be asked to show their wares.

A manufacturer of rotary engines writes us as follows:

In your issue of Sept. 18, we find the question: "Do you think it utterly impossible to construct a perfect rotary engine?" You answer, "Yes." Will you please state what you consider or what is meant by the word perfect, as we are manufacturing rotary engines which we consider perfect.

If it makes the matter any clearer we will say that we meant to express the idea that in our opinion the rotary engine could not, for general purposes, be made as successful as the reciprocating engine. For special purposes its use may be advisable. This is our opinion; of course we are open to conviction to the contrary.

The Normal Theory of the Gear Tooth Curve.

BY GEORGE B. GRANT, BOSTON.

THIRD PAPER.

APPLICATION OF THE GENERAL THEORY TO PARTICULAR CASES.

THE SEGMENTAL SYSTEM.—If a circular arc be drawn from a center A, Fig. 24, on a line at an angle, $E\ O\ A$, with a rack pitch line, $O\ F$, its normals $P\ K$ to the pitch line, will satisfy the law of the odontoid, and the segment $O\ D\ F$ will be a rack tooth that will form an interchangeable or conjugate set of teeth.

Fig. 24.

If the radius $O\ A$ is infinite, the segment is a straight line $M\ O\ N$, at right angles at O with $O\ A$, and the common involute system will be formed. Therefore the involute tooth is a special form, the infinite form, of the segmental tooth.

The segment has exactly the valuable properties of the involute at the pitch line, and approximately away from it, the approximation being closer as the radius $O\ A$ is longer.

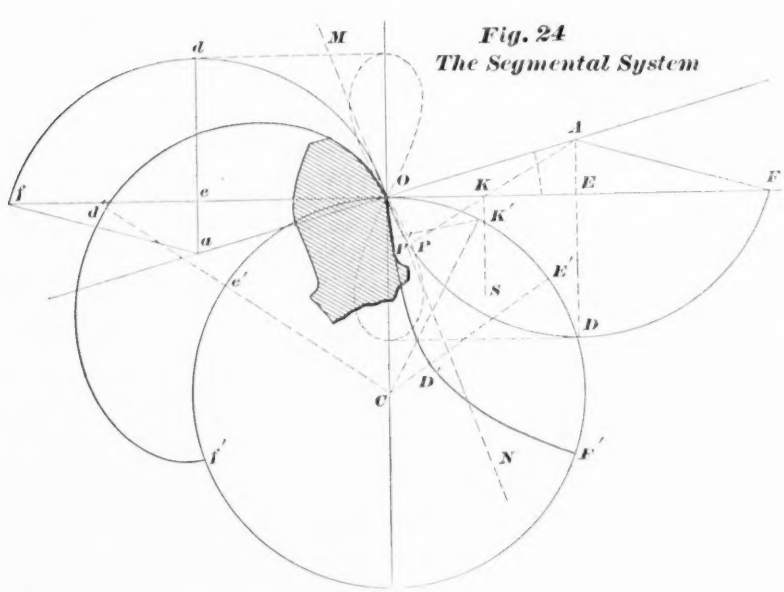


Fig. 24
The Segmental System

The involute tooth is often, but not properly, regarded as the special case of the cycloidal tooth for a rolling circle of infinite diameter. Regarded simply as a curve, the involute is an infinite cycloid, but regarded as a gear tooth curve it is not, for, as shown by Fig. 37, infinite cycloids have a mathematical but not a practicable contact, and cannot bear properly, unless the conditions of the movement are so far strained that one is reversed on its pitch line, and then the pitch lines are separated.

FORM OF THE SEGMENTAL TOOTH.—The face of any segmental tooth, on any circle with center at C, will be a lobe, $O\ d'\ f'$, where $e'\ d' = e\ d$, and $O\ e'\ f' = O\ e\ f$. It is always at right angles at O with $O\ a$.

The flank curve $O\ D'\ F'$ is at right angles at O with $O\ A$, has the same height $D'\ E'$, and the same base $O\ E'\ F'$ at the rack face.

If a, O and A are in the same line, the face and flank will join at O, and be a single curve.

Fig. 25.

CUSPS OF SEGMENTAL FLANK.—When the radius $O\ A$, Fig. 25, is small, compared with the radius OC, the pinion flank takes the form shown by Fig. 24; but as the proportion $\frac{OA}{OC}$ increases, a value will be reached, when $\frac{OA}{OC} = \frac{2}{4}^7 \text{ sin. } AOE$, at which a double cusp, $Q'\ R$, will form. At exactly that point the two points Q' and R will coincide, and no cusp will be apparent, but the slightest increase of the proportion will separate the points.

In the most convenient system, where $AOE = 14°\ 28'\ 40''$, and sin. $AOE = \frac{1}{4}$, the cusps will appear whenever the segment and pinion radii are in the proportion $\frac{OA}{OC} = \frac{2}{4}^7 \cdot \frac{1}{4} = 1.687$.

As the proportion $\frac{OA}{OC}$ increases, the second branch $Q'\ R$ will increase so that the curve will take the form $OQ'\ R'\ D''$, and when OA is infinite the second branch, $Q'\ Z$, then an involute, is infinite.

Fig. 26.

THE SEGMENTAL DELINEATOR.—The segmental curve can be formed by the "conjugator" previously described, and shown by Fig. 13, and it can be drawn by the special delineator, shown by Fig 26.

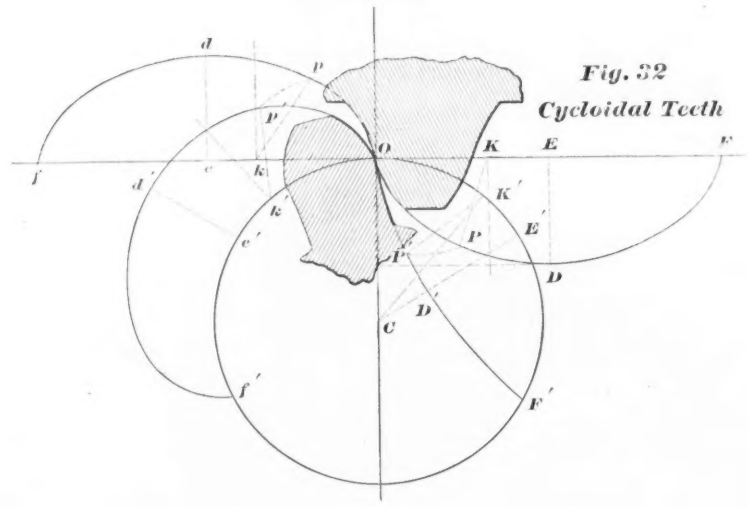


Fig. 32
Cycloidal Teeth

A thin wooden wheel, C, turns on a pin at its center, and a rack, B, rolls on it, being held to it by a strip, $a\ O\ c$, of thin brass or strong paper attached to both. It is kept in position by a guide, H.

A fixed bar G, projecting over the wheel, carries a pin O, placed exactly at the point of contact of wheel and rack. A rule E turns about a pin A in the rack B, and carries a pointed tracing pin or pencil point at P. The pins $A\ O$ and P are in line, and all three are always at the same distance from the straight edge of the rule E. The pin P will pass under and come in line with the pin O.

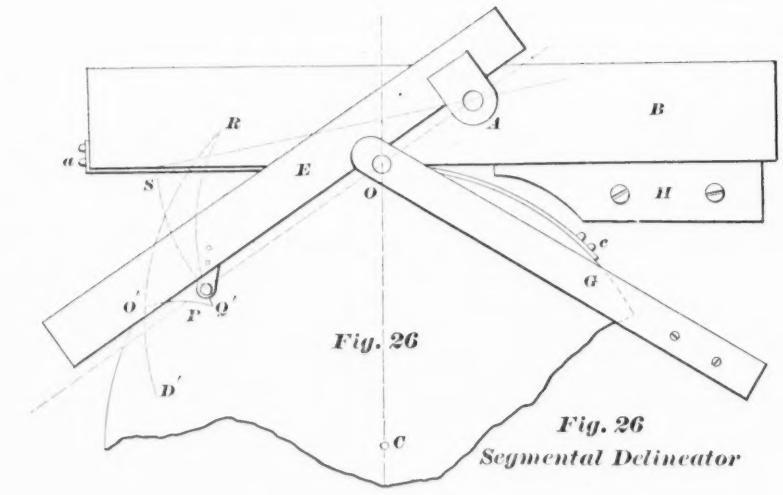


Fig. 26

Fig. 26
Segmental Delineator

As the rack is rolled on the wheel, the rule will turn about the pin A and slide on the pin O. The point P will trace a segment of a circle $P\ S$ with respect to the rack, but on the wheel will trace out the segmental flank $O'\ Q\ R\ D'$.

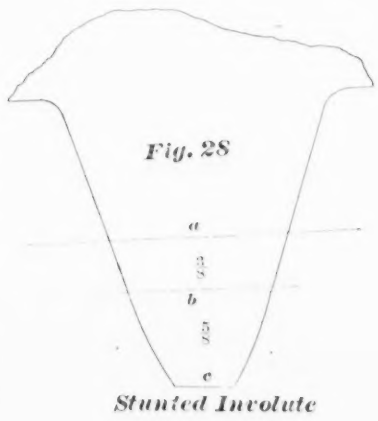


Fig. 28

Stunted Involute

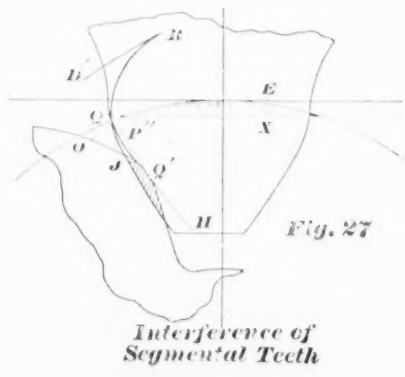


Fig. 27

Interference of Segmental Teeth

If the pin A is carried by an arm on the other side of the rack pitch line, the face of the pinion tooth will be drawn, but, as the form of the face is very simple, the utility of the instrument is confined to the flank curve.

Fig. 27.

INTERFERENCE OF SEGMENTAL TEETH.—The action of the segmental rack tooth on a flank that is conjugate to it, when the proportion is such that a cusp is formed, is always mathematically perfect, but not always practicable or capable of mechanical use.

The action is practicable until the point of contact arrives at the first cusp Q' of Fig. 27; but beyond that, when it is on the second branch $Q'\ R$, the flank curve is inside the rack face, and the action is impracticable.

There will also be an actual interference with the first branch. When the point of contact is on the second branch, the rack face will cross the first branch at J, and therefore the addendum must terminate the rack tooth at the point Q that conjugates with the cusp Q'.

The difference between theoretical and practical contact is illustrated by the two machines, the conjugator of Fig. 13 and the delineator of Fig. 26. A full rack tooth on the conjugator will form the first branch correctly, but when the cusp is reached will return on it and cut it away, while the delineator, having but one acting point, will follow the theory and trace out all three branches.

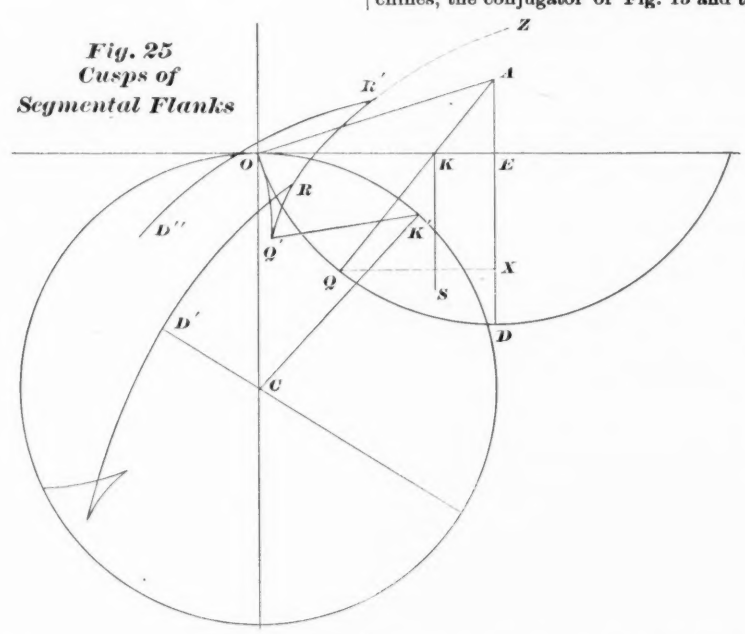


Fig. 25
Cusps of Segmental Flanks

LEAST NUMBER OF TEETH.—Therefore, if the addendum is fixed, and it usually is, interference will generally set a limit to the diameter of the smallest pinion with which a rack tooth having the given addendum will work, without bearing on the second branch of the pinion flank.

The diametral pitch being unity, a the addendum EX, Fig. 25, b, the segment radius OA, and V, the angle of obliquity AOE, the smallest possible number of teeth is

$$t = \frac{2a \text{ sin } V}{\left(\frac{a}{b} + \text{sin } V\right)^3} \qquad (1)$$

If $b = \infty$ for the common involute system, $a = 1$, and sin. $V = .25$, this formula gives $t = 32$. Therefore, the common involute system cannot have an addendum of unity on an interchangeable set having gears with less than thirty-two teeth. When the set includes 12 teeth, as is usual, the addendum must be shortened, or the points must be rounded over, as at $QQ'H$, Fig. 27.

If we have given the angle of obliquity, the addendum, and the number of teeth in the smallest pinion, the largest possible segment radius that can be used is

$$b = \frac{a}{\sqrt[3]{\frac{2a \text{ sin. } V}{t}} - \text{sin. } V} \qquad (2)$$

This, for the common case, where $a = 1$, $t = 12$, and sin. $V = .25$, gives $b = 10.34$ as the radius for the usual twelve-tooth system. A radius of 13.91 will allow 15 teeth, 16.95 will allow 16.95 teeth, 23.58 will allow 20 teeth, and a short radius of 8.44 will admit a 10-tooth pinion.

THE NATURAL SET.—There is one particular

proportion of segment radius to pinion radius, that might be considered the natural limit to the interchangeable system, and that is the proportion at which the cusp first appears. If that, or a smaller proportion is chosen, there is no limit set to the addendum, and no interference is possible, for the second branch of the curve never appears.

For that point we have the relation

$$b=3\tfrac{3}{8}\ t \text{ sin. V}, \qquad (3)$$

so that, by choosing some value of t as the lower limit, we can find b for the whole set. If sin. $V=.25$, we find $b=\frac{2}{8}\frac{7}{8}t$, giving $b=8\frac{7}{16}$ for a ten-tooth set, $b=10\frac{1}{8}$ for a twelve-tooth set, $b=12\frac{9}{8}\frac{1}{6}$ for a fifteen-tooth set, $b=27$ for a thirty-two-tooth set, and so on.

If we use the plan previously explained, and calculate by formula (2), we can get a greater value for it, but in that case the addendum is limited to its chosen value.

As the addendum is always limited in practice, almost always being unity, formula (2) appears to be better adapted to practical purposes than formula (3).

Fig. 28.

Corrected Involute Tooth.—We have seen that the true involute tooth, when sin. $V=.25$, cannot be used for an interchangeable set that includes gears with less than thirty-two teeth, if the addendum is unity.

It is, however, customary to use the full addendum on a set that includes twelve teeth, with the result that it must be corrected (?) for interference by rounding over the corners as in Fig. 27.

Formula (1) will apply to the involute if $b=\infty$. In that case $\frac{a}{b}=o$, and

$$a=\frac{t \text{ sin.}^2 \text{ V}}{2} \qquad (4)$$

If $t=12$, and sin. $V=.25$, we have $a=\frac{3}{8}$, so that the common involute, Fig. 28, is limited to the addendum $ab=\frac{3}{8}$, and the additional $bc=\frac{5}{8}$ of the full addendum must be cut off or got out of the way by rounding off as much of it as would interfere with a twelve-tooth pinion.

This additional five-eighths is not interchangeable, is not a tooth curve, and is kept on merely to give the appearance of a whole tooth. What usually appears to be a full addendum, is really stunted to but little more than its third part.

Fig. 29.

The only true correction, the only device that will allow of a full addendum of unity, retain the true involute for any part of it, and permit a rack to run in a pinion of less than thirty-two teeth, would be to correct the rack tooth by rounding over the point as in Fig. 29, to give the flank the same correction, so that the condition of interchangeability is satisfied, and then to form a conjugate set from the corrected rack tooth. The result would be a mixed action: true involute, near the pitch line, and epicycloidal or otherwise away from it.

This plan would have the serious defect that the corrected part bd must be a very defective odontoid, with a jerky and very nearly impracticable action; for, to obtain the necessary correction between b and d the curve must turn so quickly that its normal intersections with the pitch line must be crowded within a narrow limit mn.

Therefore, it would not appear to be advisable to correct the involute at all, for low-numbered pinions, but to discard it altogether, or to keep up appearances, as at present, by a merely ornamental and deceptive extension to nearly three times its effective length.

If it is discarded, its valuable peculiarities will be lost, and therefore its substitute should be the curve that is nearest like it, and most nearly has its properties.

Evidently, the nearest possible approach to the involute, is the segment that has the same angle of obliquity, and the longest radius that will admit the required addendum on the required smallest pinion, as found by formula (2).

Fig. 30.

Figs. 29 and 30 serve to compare the action of the corrected involute with the segmental tooth. The action of the segment, Fig. 30, is exactly the same as that of the involute at a, and its rapidity gradually increases to the finish at n. The corrected involute action, Fig. 29, is uniform from a to m, and finishes with a sudden jerk from m to n.

If the correction should be curved enough to cause any of the normals to meet on or outside of the pitch line, the action would be wholly impracticable.

The Cycloidal System.—The cycloidal system is generally, but not properly, called the "epicycloidal" system. It is no more epicycloidal than it is hypocycloidal, for the faces are of the one form, and the flanks of the other. It is simpler and easier, as well as more correct, to apply the name cycloidal to both face and flank, and to the whole system, as is sometimes done.

As before stated, the cycloidal system can be more easily developed and studied by the "rolled curve" theory than by the normal theory, because its roller, the circle, is the simplest of all curves. But, in this place, the former theory will not be used further than to define the nature of the cycloid, which is the generating odontoid that forms the system.

Fig. 31.

The Cycloid.—If a circle A, Fig. 31, is rolled on the straight line OF, a fixed point, P, in it will trace out a transcendental curve, $OPDF$, called the cycloid.

It is a lobe, having a height, DE, equal to the diameter of the roller, and is at right angles at O and F, with a base, OF, equal in length to the circumference of the roller.

As with all rolled curves, the line PK, from the tracing point to the tangent point, is always a normal to the curve, and therefore, to draw a normal to any given point P, strike a circle through the point having a diameter equal to the height DE, and tangent to the base line, and draw the normal PK to the point of tangency.

As the arrangement of the normals is consecutive, the curve is an odontoid, and all curves formed from it will be similar odontoids that will work interchangeably with it.

Fig. 32.

The simple process for drawing the normal makes it easy to form the conjugate face or flank belonging to any pitch circle. The flank cycloid Odf, Fig. 32, forms a face on the pinion, which is always a lobe $Od'f'$ at right angles at O with the pitch line, and meeting it again at f'', where $Oe'f''=Oef$.

The face cycloid ODF forms a flank, $OD'F'$, on the pinion, that is at right angles with the pitch line at O, meets it again at F', where $OD'F'=ODF$, and which takes various forms, according to the size of the pinion compared with that of the cycloid.

When the radius OC, of the pinion, is greater than the height ED of the cycloid, the flank will be a concave lobe, $OD'F'$.

Fig. 33.

When the radius OC is equal to the height ED, as in Fig. 33, the flank will be a straight diameter OF'.

Fig. 34.

When the radius is less than the height, as in Fig. 34, the flank will be a convex lobe.

As an undercurved flank, as in Fig. 34, is weak, it is customary to so limit the radius of the pinion that it shall never be less than the height of the originating cycloid.

As the proportion of ED to OC still further increases, the flank is still more undercurved, until when $OC=\frac{1}{2}ED$, we have the base, OF, equal to the circumference of the pinion; and the flank is concentrated to a single point at O. The wearing action is also concentrated at the single point, and such a tooth, although practicable, is quite useless.

Fig. 35.

If the height of the cycloid is greater than the diameter of the pinion, Fig. 35, the flank is a lobe, entirely external to the pitch line; and although the contact is still mathematically perfect, it is no longer practicable, for it is on the inside of the cycloid, as shown at P', Fig. 35.

Fig. 36.

If the proportion is carried to its extreme, the height being infinite as compared with the diameter of the pinion, as in Fig. 36, the cycloid becomes the straight line OD, and the pinion flank is the involute OD'. From this it is plain that the involute, in the form of an

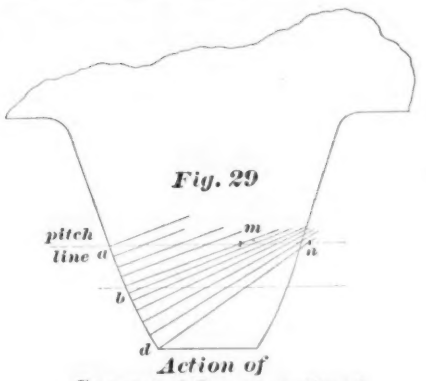


Fig. 29

Action of Corrected Involute Tooth

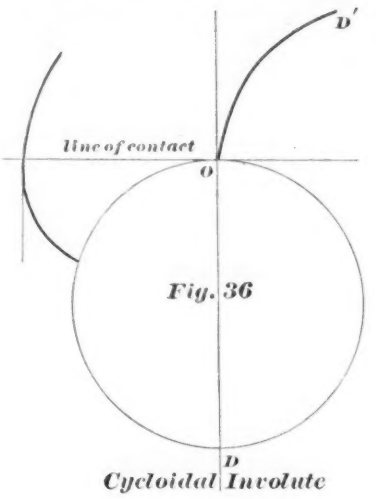


Fig. 36

Cycloidal Involute

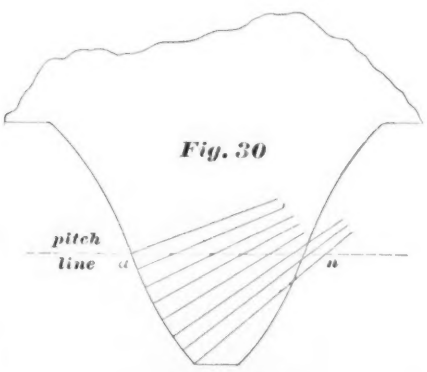


Fig. 30

Action of Segmental Tooth

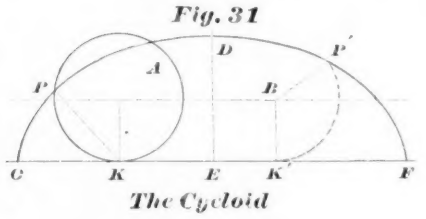


Fig. 31

The Cycloid

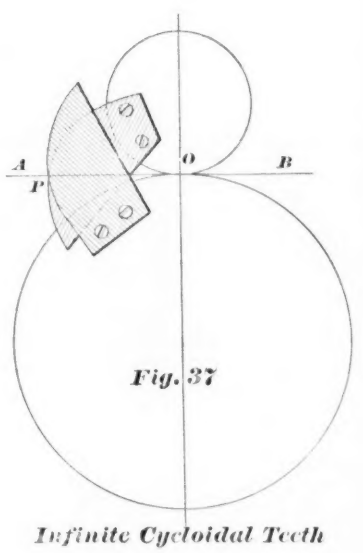


Fig. 37

Infinite Cycloidal Teeth

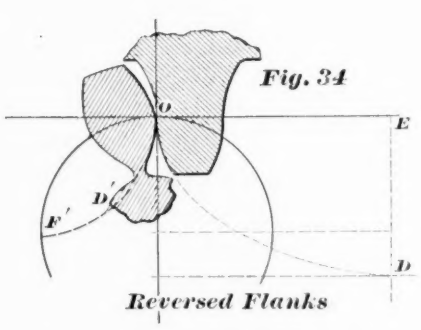


Fig. 34

Reversed Flanks

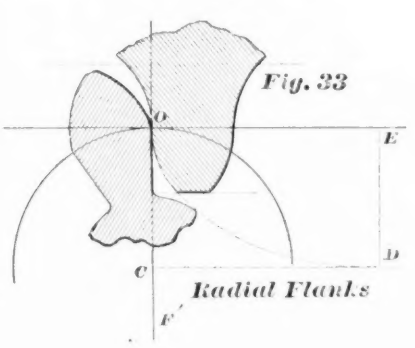


Fig. 33

Radial Flanks

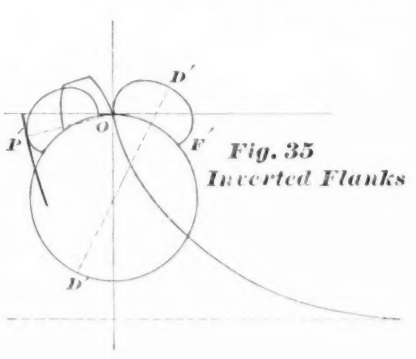


Fig. 35

Inverted Flanks

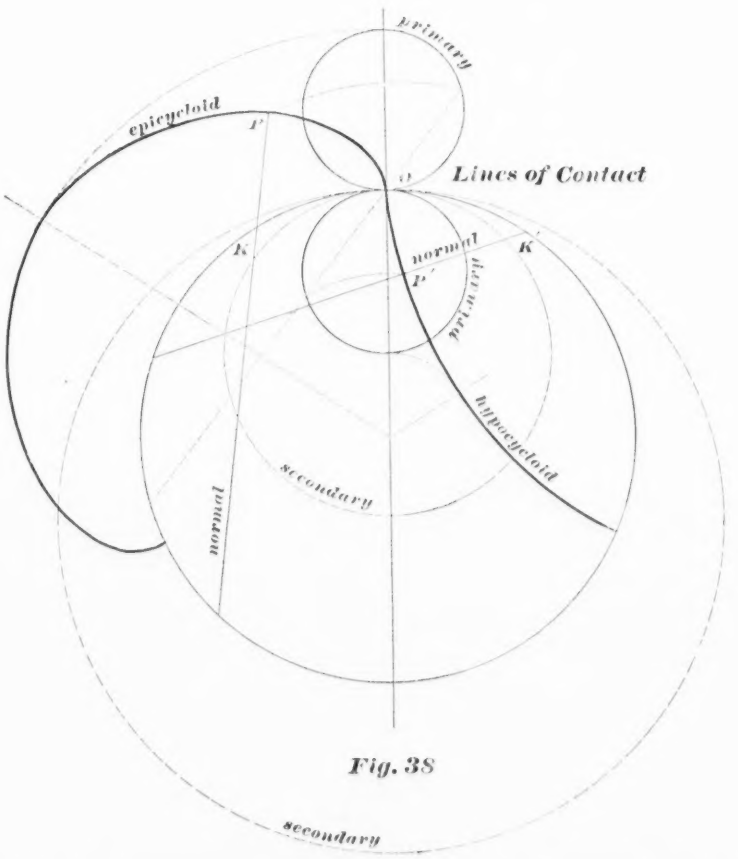


Fig. 38

infinite cycloidal odontoid, is not a practicable gear tooth curve, the action between two gears being, as in Fig. 37, always on the straight line AOB at the crossing of the two tooth curves.

Fig. 37.

Cycloidal Lines of Contact.—The primary lines of contact, in the case of the cycloid, are circles, Fig. 38, of the same diameters as the heights of the originating cycloids.

Fig. 38.

The secondary lines of contact are also circles. The diameter is equal to the pitch diameter plus or minus the height of the cycloid.

Internal Interference.—With cycloidal teeth we cannot have a partial interference, as with segmental teeth, which can be remedied by truncation of the teeth, for the exterior secondary of the pinion is either entirely inside the interior secondary of the gear or entirely outside of it, except in the case of entire coincidence. If the difference between the pitch diameters is less than the sum of the heights of the originating cycloids, there can be no interference, but if it is greater there will be a continual interference that can be remedied only by the entire removal of the face of one of the teeth. The condition of non-interference can be conveniently expressed by the rule that the difference between the numbers of teeth on the gears must not be less than the half sum of the numbers of teeth on the base gears. This, for the common interchangeable system, requires that there should be a difference between the gears at least as large as the base gear. For example, in the fifteen tooth set there must be at least fifteen more teeth in the gear than in the pinion.

Double Internal Contact.—When the condition of non-interference is exactly satisfied, there is a case of double contact, for then the two secondaries coincide. In a case of double contact of interchangeable teeth, the coinciding secondaries must exactly bisect the chord $c\ d$ of Fig. 20, for the primaries are equal, and their chord $e\ f$ is exactly bisected in that case. As the circle is the only curve that will bisect all the chords $c\ d$, it follows that the cycloidal system is the only one that can have double contact, and at the same time be interchangeable.

Practical Construction.—The practical application of the conjugating process, in the case of the cycloid, presents the difficulty that the originating rack tooth must be an exact cycloid, which condition can be met only by special mechanism.

The originating segmental tooth has an outline that is formed of arcs of circles, and that of the involute is composed of straight lines, and both can be easily shaped. But the difficulty in the practical application of the cycloidal system is not by any means the greatest objection to it in comparison with its simpler and superior rival.

Dangerous Boiler Connections.

FROM "THE LOCOMOTIVE," PUBLISHED BY THE HARTFORD BOILER INSURANCE COMPANY.

Probably the most dangerous style of connecting boilers that could be devised is that shown in Fig. 1, where each of two or more boilers is provided with its own stop-valve, so placed that steam can be shut into the boiler, while only one safety-valve is provided for the whole battery, this valve being placed upon the steam-drum beyond the stop-valves. Such an arrangement is bad enough when each boiler has its own steam-gauge connected directly with the boiler; but it is doubly dangerous when but one steam-gauge is provided, connected as shown in the figure. It will readily be seen that if one boiler is shut down for any reason, the stop-valve must be closed, and there will be a chance that when again put into use, the attendant may forget to open the valve. If he does forget this, there is almost a certainty that a rupture of some part of the boiler will result. We have known of several explosions which have occurred from this cause. The one from which the wreck shown in our illustrations resulted, occurred but a short time since. The owners of the boilers were careful and responsible men who wanted things all right, and supposed, when the boilers were set and connected, that everything was as it should be. The steam-fitter, however, put the work up as shown in Fig. 1; and the owners, not being practically familiar with this kind of work, thought it was all right.

For some reason or other, one boiler was shut down, and the steam gauge removed for repairs. When the boiler was again fired up, the engineer neglected to open the stop-valve, and, there being no outlet for the steam or conection with the safety-valve, a terrific explosion followed, portions of the boiler being thrown over 700 feet. Fig. 2 shows the front end of the left-hand boiler; Fig. 3, the rear end of same boiler, which was thrown nearly 300 feet, while Fig. 4 shows the upper portion of the steam-drum.

We have had Fig. 5 engraved to show how these boilers should have been connected. A safety-valve for each boiler is placed directly upon the shell, there being no possible chance to cut off the communication with the boiler. Each boiler is also provided with its own steam pressure gauge, directly connected. Had the boilers been connected in this manner, the explosion, with its accompanying loss of several thousands of dollars, would never have occurred.

The first rule to be observed in conecting up steam boilers is: Never put a stop-valve between the boiler and safety-valve.

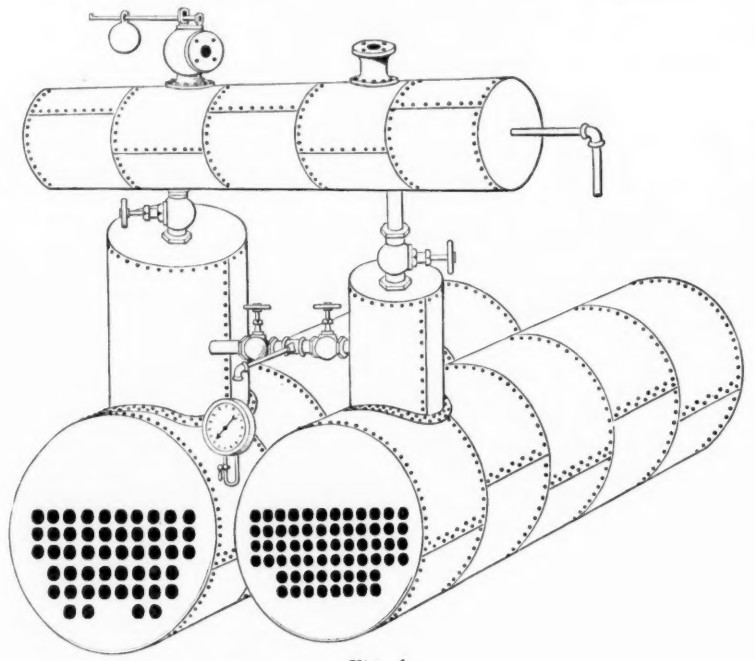


Fig. 1.

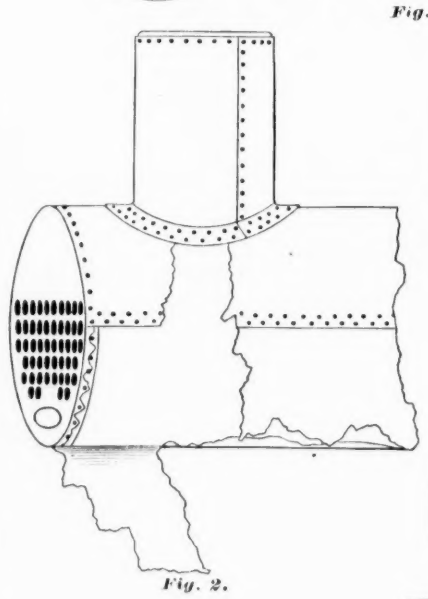


Fig. 2.

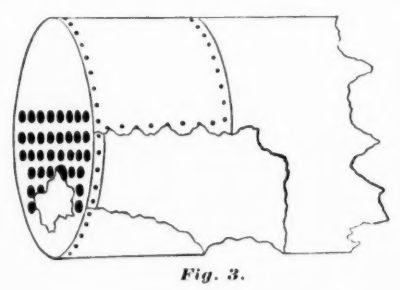


Fig. 3.

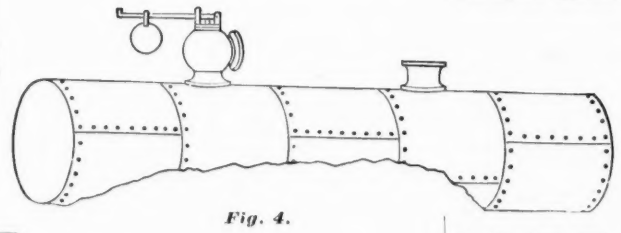


Fig. 4.

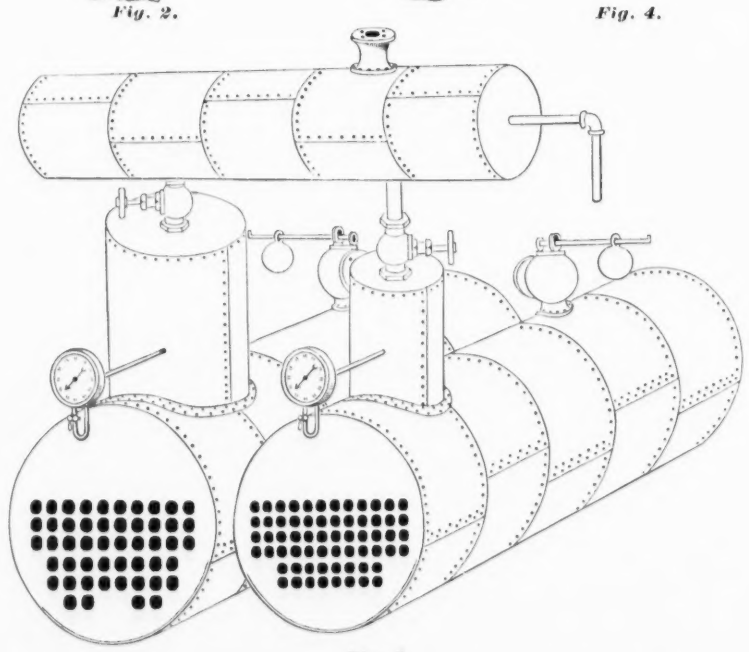


Fig. 5.

The *Mechanical World* of Manchester has a review of English and American locomotives and closes thus:

From the foregoing it will appear that there is nothing in American locomotive practice differing greatly from the modern practice of our own stationary engine builders. It is not many years since gun-metal slide valves were common enough, or since eccentric straps were of the same metal or of wrought iron. All this has pretty well disappeared, and we only find cast iron employed with safety and economy; but in locomotive practice we have adhered to the older rule, and therefore have been unable to reduce the cost of locomotives in the same ratio as first-class stationary engines. In America both classes of work have run in parallel grooves, with corresponding advantage to the locomotive builder. It would have been impossible to convey in so few words a description of English locomotives which should as accurately describe general features as have sufficed in our brief description of the American engine. What we have said applies not only very largely to both goods and passenger engines, but also to the builds of different makers. In the one item of cylinders alone, whilst the whole of the American practice is combined in the words—outside, horizontal with top valve chests, English practice is ranging all over the field and includes every feasible inclination either up or down, inside or outside, with valve chests anywhere. To pull a train of 150 tons on the Midland Railway requires something very similar but still different from what is required on the Lancashire and Yorkshire or the North British. The Manchester, Sheffield, and Lincolnshire again differ in slight particulars. The London and North-Western and Great Northern differ again, and for their own traffic will use two different engines for the same train on different days. We have no uniformity in a country wherein no place is 1000 miles from any other, and climate and general contour of country are equal. In America, over a territory vastly greater in distances and variations of climate, no such wide discrepancies of practice appear, and comparatively few classes cover the range of requirements. For main line work they have the four-coupled passenger engine of the "American" type, for heavier traffic the six coupled "Mogul" type, and for heavy freight work the "Consolidation," or eight wheels coupled engine, of each of which types we give a perspective view. American locomotives have been usually very poorly supplied in the matter of the foot plates. Very poor apologies for these are to be found, a mere shelf attached to the side of the boiler barrel being all that exists. Now, however, we are informed that more substantial plates are fitted, so as to render the duties of the engineer much safer than they have been. In this respect American builders may well take a lesson from English practice, which embodies foot plates of great width.

At a recent meeting of the British Association William Anderson, of Erith, read a short paper "On the Lafitte Process of Welding Metals." With a view to overcome the difficulties in spreading borax or other fluxing materials over the heated surfaces in making welds, M. Laffitte had invented plates, usually consisting of a very pliable wire gauze, on both sides of which the flux, being highly vitrified, is evenly spread. Paper may be also used as a support. In cases of small surfaces it is often sufficient to form a sheet of the flux and metal filings agglomerated together. The plates are simply placed between the surfaces, in place of the powder being sprinkled on; the wire gauze being welded in between the surfaces. A table of tests made was shown on the wall, the results being highly favorable to the system. Mr. Anderson attributed a great part of the success to the much lower temperature at which the welding could be accomplished. Examples of welding by this system were also shown, all of great interest; perhaps the most remarkable was the case of a hammer head, in which a face of tool steel had been welded on to an ordinary hammer head forging. This hammer had been in ordinary shop use for six months. To weld tool steel to iron is certainly a remarkable achievement, and one that marks an era in the history of the smith's handicraft.—*Engineering.*

Our esteemed contemporary, the *Evening Herald*, of Syracuse, is a thoroughly enterprising newspaper. It does not rely upon the time-worn dodges practiced by metropolitan dailies to boom an already large circulation, but originates a plan of its own. It has been carrying on a free exhibition of Onondaga county relics and other antiquarian curiosities. Among the collection is the original Cardiff giant and lots of smaller relics, which attract crowds of people every day. We wait to see some of the New York dailies start a show of the same kind. Their private collection of relics would be interesting.

Moulding Pulleys.

By Robert E. Masters.

In making an experimental machine two pulleys were wanted, one-half of the pulley 48″ diameter, 8″ face straight, the other half below the arms to be 8″ face and taper from 48″ to 42″ diameter, as seen in the drawing.

First a lifting plate *A* was cast and wrought-iron nuts cast in it so that it could be lifted out with $\frac{5}{8}$″ eye bolts. Wrought-iron rods *B B* were also cast all around the edge of the plate to form a basket. In moulding the pulley the spindle and strike were set, and the inside diameter of the tapered half of the pulley *C C* was struck up and a paper parting tacked over the surface. The lower lifting plate *A* was then set in, the eye bolts extending up as high as *D D* were left in the plate, and the lower core was rammed up and well secured with rods, as shown by the dotted lines and dots.

A pulley ring pattern, 24″ outside diameter, the inside diameter corresponding with the lower core, was fitted on, the arms bedded in and the parting made. The eye bolts were then unscrewed and taken out from the lower plate, and the holes covered over with pieces of pasteboard. The upper lifting plate shown by the dotted line *E E* was fitted in. The large dots under *D D* represent a section of the ribs of the plate over the arms.

The ring pattern was then rammed up and drawn to the right height, the same as any pulley made from a band. The cope was lifted off, the ring drawn from the mould, the cheek lifted off and the upper core taken up and suspended on trestles, the pasteboard removed from over the holes for the eye bolts, and the eye bolts screwed back in their places. The arms are then drawn and the lower core lifted out and set aside.

The holes made by the points *G G* on the lower plate were covered over with thin cast-iron plates to keep the sand out of them. The spindle and strike were set back and the mould struck off to the outside diameter of the pulley. After dressing up the mould the lower core was set in, the eye bolts taken out and the upper core set on. The joint was dressed up, and the mould finished and weighted down. After the pulley was cast the rods *C C* were bent in far enough to let the plate come through the lower end of the pulley.

We have made this pulley the narrow side up or the reverse to that illustrated; of course in that case only one lifting plate was used, and if one has a full pattern it is the quickest and best way to make it. Small pulleys of this description can be made with the cone half up and a dry sand core used to form the inside of the pulley over the arms.

By-Laws of a Successful Co-operative Foundry.

We receive many inquiries about organizing co operative manufactories. As an example of organization we publish herewith the by-laws of the Nashua Co-operative Iron Foundry Company of Nashua, N. H., adopted in May, 1884, three years after the company started in business. The original capital was $4,000.

BY-LAWS.

Article 1. This company shall be known by the name of the "Nashua Co-operative Iron Foundry Company." The business of this company shall be the manufacture of iron castings, and the sale thereof.

Article 2.* The capital stock of this company shall consist of sixteen thousand dollars, divided into one hundred and sixty shares of one hundred dollars each.

Article 3. The salary of the officers shall be fixed at the yearly meetings.

Article 4. The officers of this company shall consist of a president, treasurer, and of not more than nine directors, who shall be styled a Board of Managers. They shall also have a corporation clerk and foreman.

Article 5. The Board of Managers shall have power to make such prudential by-laws as they may deem proper for the management and disposition of the capital stock and business affairs of the company, not inconsistent with the laws of this State, as they may elect, and of the prescribing of the duties of officers.

Article 6. It shall be the duty of the president to preside at all meetings of the directors and stockholders; he shall make and execute all contracts as directed by the Board of Managers; he shall be the authorized agent of the company, and his signature, when attested by the clerk, shall be the bond of the company.

Article 7. The clerk shall keep a correct record of the meetings of the stockholders and the Board of Managers; he shall be chairman of the Finance Committee, and perform such other duties as the Board of Managers may prescribe.

Article 8. The treasurer shall have charge of the funds of the company; he shall receipt for all money received by him and deposit the same in such place as the Board of Managers may designate; before entering upon the duties of his office he shall give bonds in the penal sum of five thousand dollars for the faithful performance of the duties of his office, said bonds to be acceptable to the Board of Managers.

Article 9. There shall be annual meetings of the stockholders for the choice of officers, held on the second Monday in May of each year, and special meetings of the stockholders may be called by the president at any time, by giving seven days' notice of the time and place of, and object of the meeting, by mail or otherwise, to all the stockholders; and in the absence or inability of the president to perform the duties of his office, it shall be the duty of the clerk, upon application of five or more of the stockholders of the company in writing, setting forth the object of the meeting, to notify the stockholders in the same manner prescribed by the president.

Article 10. The Board of Managers shall hold regular meetings at least once a month, or when ordered by the president, for the transaction of any business that may require their attention; it shall require a majority of the board to constitute a quorum for business.

Article 11. There shall be such distribution of the profits or earnings of the company among the stockholders as the directors may determine to be the most advantageous to the company, and not inconsistent with the laws of this State; provided that one-tenth at least of the net earnings or profits be appropriated for a contingent or sinking fund, until said fund shall have accumulated a sum equal to 30 per cent. of the capital stock.

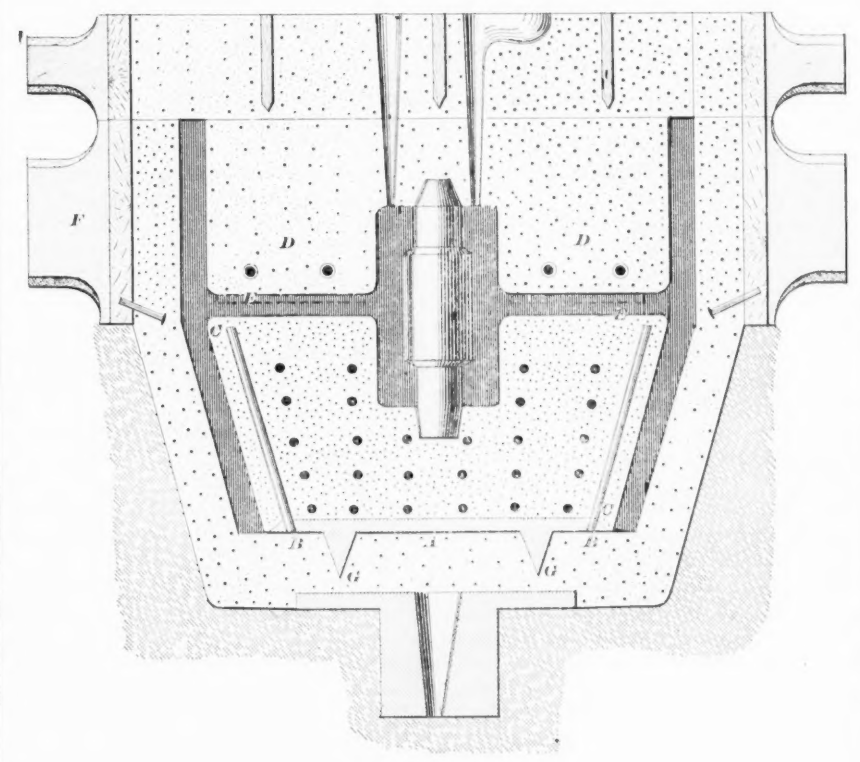
Article 12. Members employed by this company shall conduct themselves properly, and for the interest of the company; failing to do so, they subject themselves to dismissal by the foreman or superintendent, and they shall not be again employed without the consent of two-thirds of the Board of Managers.

Article 13. In taking apprentices, the sons of stockholders shall have the preference.

Article 14. These by laws may be altered or amended at any regular meeting of the stockholders, but any alteration will require a vote of two-thirds of the stockholders present.

Article 15. The officers of this company, including the president, clerk, foreman and the Board of Directors, shall be elected by ballot; also the Finance Committee, which shall consist of three members.

* The capital stock was increased to $8,000, Sept. 12, 1881, and further increased to $16,000, Oct. 4, 1883; in each case by a unanimous vote of the stockholders. Due notice of the above increase was in each case forwarded to the City Clerk and Secretary of State, as by law required.



Moulding a Pulley.

Manufacturers ought to date their catalogues. Some of their information is very blind. For instance, we have a very well-printed and finely illustrated catalogue of machinery before us which begins: "We herewith present our eleventh annual catalogue." Then follows a notice of what "we added last year," but what year cannot be discovered by a perusal of the pamphlet itself. Nothing is to be gained by obscurity in circulars or catalogues of good machinery.

We notice in the *Penman's Art Journal* a report of the proceedings of the Business Educators' Association. Prof. W. E. McCord urged that political economy should be taught in commercial schools and made out a very strong case. Among other things he said:

It is gratifying in the highest degree to see the rapidly increasing favor with which business educators regard such instruction. We are all of us convinced that it is not only legitimate work for the business colleges, but it is a solemn duty as well as golden opportunity which it would be criminal for us to neglect.

Commercial law is well established in our schools. By it we teach what men require of each other in the conduct of business. We teach that gain in violation of these is no gain, and will be followed by penalty as surely as men are faithful in executing the law. Should we not also teach the natural laws of trade, and that violation of these will bring disaster to some one as certainly as God is faithful in executing the laws he has made in nature? It seems to me that political economy follows naturally upon the adoption of commercial law, and is by far the more important and useful of the two.

It is by political economy that we may best accomplish what Prof. Adler so earnestly appealed to us to do. By it, we may give the student the true idea of wealth-getting; that his mission is not to prey upon society, but to minister to its material and moral upbuilding. And surely no work is more imperative than this.

LETTERS FROM PRACTICAL MEN.

Turning Soft Rubber Rolls.

Editor American Machinist:

Your correspondent who inquires how to turn soft rubber rolls will succeed if he uses sandpaper held on a block. The block should be secured in position against the roll, and the latter revolved at a good rate of speed. If the roll be long the block should be held on a slide-rest and fed from end to end, back and forth, until the rubber is no longer cut by the sand. E. D. Mackintosh.

Emery Wheels for Turning Rubber Rolls.

Editor American Machinist:

Having noticed a request in your last issue as to how soft rubber rolls can be re-turned, I will say that by placing an emery wheel on an ordinary lathe carriage, and a drum overhead as long as rolls to transmit power to wheel, I think your correspondent will have no trouble in perfecting his job.

A coarse corundum wheel is even better, and should be reduced to $\frac{1}{8}$″ on edge. Run at good speed and at reverse motion to roll.

C. D. Rice.

Hartford, Conn.

Turning Rubber Rolls with a File.

Editor American Machinist:

I see in your paper of Sept. 25th that a correspondent would like to know how to turn soft rubber rolls. Let him place his roll in an iron turning lathe and place a sharp bastard file one end on a tool in post, the other end under roll, on a slant to carriage. Run fast and use feed both ways till true. Finish with sand paper.

Geo. L. Fairbanks.

Worcester, Mass.

Moulding Screws

Editor American Machinist:

I use screws or grooved rolls, $2\frac{1}{2}$ inches diameter and 8 inches long, with endless thread, 2 inches lead forward and 5 inches backward. The thread groove is nearly square, $\frac{3}{8}$ inch wide and deep; a single cresent runs in the groove reciprocating the carriage of an apple parer.

Although given up by a number of foundrymen and machinists, I determined that it should be cast. I cast it as follows: I first made the pattern solid, giving about $\frac{1}{16}$ inch draft. The pattern was cut in halves as usual, then each half was cut in five pieces, the pieces being suitably doweled. It is moulded as follows: One-half is assembled and placed upon the board, a flask set over and filled. The other half is then set on and cope filled; this half lifts off with the cope. A draw iron is inserted in the center piece of pattern, which is lifted vertically. The side pieces are then drawn horizontally until free from the mould, the remaining pieces are then drawn out an angle of about 40° until free from the mould, and then lifted out. A wrought-iron rod is laid in for the shaft.

Although I had at first to mould these pieces myself, I now have no trouble in getting them made.

I dress out the grooves with a thin emery wheel, which was claimed to be an impossibility.

Rochester Schools for Mechanics.

Editor American Machinist:

Enclosed find circular showing what is being done in our city for the apprentices and young mechanics who are looking forward to improvement. It is intended that boys and young men from shops and factories shall have preference. The principal, Mr. Colby, was here last year, and came from a similar school in Springfield, Mass. He has an assistant this year in Eben Rose, formerly of Providence, R. I.

The indications are that very large classes will be formed.

In addition to this school, the Board of Education has ordered a night school to be opened in the rooms of the Rochester Free Academy on Monday, Wednesday and Thursday evenings from 7.30 to 9.30 p. m., and have detailed Professors G. H. Walden and E. C. Sparlin to take charge of the same; so you see the people here are realizing and appreciating the value and necessity of educational advantages for our young mechanics, more especially in those branches that directly concern their daily vocations.

J. S. Graham & Co.,
Rochester, N. Y.

[The circular of the Mechanics' Institute, of Rochester, mentioned above, gives notice that the school will open, for the second year, September 25th. Any person of the age of fifteen years or over, of good moral character, may join the school. The school will accommodate about 200 pupils. Each pupil deposits $1, which will be refunded to him at the end of the school year if he has attended 80 per cent. of the lessons. Evening classes are instructed from 7.30 to 9.30; day classes, from 2.30 to 4.30. Special classes in drawing, painting and modeling pay a tuition fee, and the pupils provide themselves with instruments and materials. The course marked out in the circular covers two years.]

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interestgd in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, OCTOBER 9, 1886.

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Facts About Savings Banks.

The general condition and aspect of savings banks interest a large portion of the people of the eastern section of this country. In the West and South the importance of these institutions is very small, not because the people are poor or improvident, but because they, as a rule, invest their savings directly instead of turning them over to a coterie of individuals who have legal authority to call themselves a savings bank. In the State of New York on the first of last January the savings banks owed depositors $457,050,250 being an increase of $42,898,000 during the year 1885.

The banks reported over seventy-seven million dollars surplus on that date. The money was due to 1,208,072 depositors, which shows that nearly one individual in five of the whole population has an account in a savings bank.

The organization of a savings bank in this State is very much like the constitution of what is known as a "blind pool" in Wall street. Three or more men conclude they would like to have the disposition of considerable sums of money belonging to others without giving security, and for which but a small interest need be allowed. They apply to the Superintendent of Banking for permission to start a savings bank. He forwards them some blanks with questions to answer, and upon the return of the same properly filled out issues a permit for the bank, and the parties signing the application become the trustees. They choose a President and Secretary, who are to receive salaries, hire a room for business, hang out a bank sign and solicit deposits.

Let us suppose a workingman, who has saved some money, is attracted by the sign, enters and asks information: "What constitutes this bank?" The smiling president invites him to inspect their permit to open the bank and mentions the high standing of the trustees. "But," says the inquirer, "where is your capital, and how much is your capital stock?" "I see you don't understand the savings bank system," is the reply. "We have no stock and no capital. The high character and wealth of the trustees give assurance of honesty and safety of money. You know Major Bump is worth a large fortune, Judge Skimp is worth a million, and Squire Sizem half a million. You see your money is safe in such hands." The workman then says: "Do these men, who have large businesses of their own, give their attention to this bank, and if it should not succeed (as many enterprises fail) would they make good to depositors all the deficiency out of their private means?" "Well, ahem, you are too suspicious. Why, the whole community place unlimited confidence in these men. Why should a man like you doubt them? Of course they don't give much of their valuable time to watching this bank, nor would they pay depositors out of their own pockets if the bank fails You don't understand finance, and the trouble with you workmen is that you don't have confidence enough in others who do understand it. The subject is too deep for you."

We have supposed an unusual case, for the workman generally deposits his money (in a savings bank) without asking anything about security. The fact is, there is no security offered. Depositors hand over their money to the bank upon simple faith and confidence, but the bank managers ask tangible security when they loan it. No other kind of a bank can be established without capital. The law, of course, limits savings banks to certain kinds of investments, but if the trustees hold strictly to law, a failure of the bank does not make them responsible to depositors. All the banks in the State are subject to supervision by the superintendent of banking, but there are so many that he cannot give much time to each one.

Savings banks with large resources are believed to be very safe. The depositors, however, often find it easier to put in money than to take it out. An instance recently came under our notice. The wife of a business man had an account in a savings bank that showed more than twenty million dollars resources. She opened an account in her husband's name, depositing his individual check, which was not certified. When interest was due he wrote a check which she presented to draw the money. The bank refused to pay it because it had not the man's signature on the books, apparently ignoring the fact that they had taken the deposit upon his signature to the check. Upon being asked by the man in person why if his signature was good to a check for deposit it was not good to a check to draw out money, they declared that the rules had been changed since the deposit was made. If a depositor loses his pass-book he loses the money unless he can give a security bond to the amount of the deposit if the bank requires it. Any savings bank can exact sixty days' notice before paying a deposit or any part of it, if they choose to do so. There are many wrecked savings banks in this State within the last few years. A number of receiverships are still running and thousands of deluded depositors are waiting to see if they can recover any more of their money.

As examples of how savings banks are wound-up we may mention that the Third Avenue Savings Bank failed in October, 1875, owing nearly a million and a half. The receivers report to January 1, 1886, shows that $379,440 had been collected and $231,164 paid to depositors, (17½ per cent), and that the expenses of the receivership have been $110,833. The amount on hand was over $37,000 or about enough to pay 2½ per cent dividend, yet the receiver reports that "possibly one per cent" more may be paid to depositors. This would seem to depend upon how soon it was paid, for he reported the receivership expenses for the last six months, $13,655. The Yorkville Savings Bank failed in July, 1877. The amount collected has been $11,109, and it cost $8,086 to collect it. The Claremont Savings Bank failed in September, 1877. There has been $26,590 collected, of which the depositors got $12,279, and the receivership $12,087. Many other similar cases might be mentioned.

From what we can learn the savings bank systems of other States are as bad as this State and some even worse. Those who have saved money should examine the situation carefully before trusting their surplus to savings banks.

Literary Notes.

RECENT LOCOMOTIVES. ILLUSTRATIONS WITH Descriptions and Specifications and Details, of Recent American and European Locomotives. Reprinted from the *Railroad Gazette*. Enlarged Edition, including a Chapter on Compound Locomotives. Published by the *Railroad Gazette*, 73 Broadway, New York.

This work contains engravings of a large number of locomotives of comparatively recent construction, both American and European. A brief description is given in the text, in the main limited to that which appeared in the *Railroad Gazette*. While a more general description would add to the completeness of the work, the description given, with the illustrations, will be found quite satisfactory to those whose knowledge of the subject enables them to readily comprehend the details of locomotive construction.

So far as the descriptive matter is concerned it appears for the most part to be without prejudice, but the more purely editorial part has a decidedly English bias, which it appears to us is not tempered with justice towards American master mechanics and locomotive builders. For example, the editor, under "Locomotive Boilers," says:

It has so long been the fashion in this country to assume and assert the superiority of American locomotives over those of all the rest of the world, that it will, perhaps, excite a ripple, or may be a storm of animadversion, to admit frankly that in the construction of boilers our European competitors often excel us. * * * It is not our purpose, though, to deal with the subject as a mere matter of opinion, but to lay before our readers detailed illustrations and descriptions of one of the most recently constructed forms of English locomotive boilers, so that practical men can compare the design, if not the workmanship, with that commonly used here. * * * Before describing them it may be well to say that the form of seams known as butt-joints is almost unknown here, or at least unused here. Not a single locomotive manufacturing firm or company is using them, and if any master mechanic has ever adopted the plan the fact has never become known to the public.

Further argument is made upon the assumed merits of the butt joint, bringing in the familiar illustration of flexible material, as rubber, to show the concentration of strains in lap-riveted joints.

The principal objection to the greater part of the above quotation is that it is not true. It may not have been modesty that has kept Americans from setting forth the merits of American locomotives. It is probably because they have found it only necessary to quote from English journals, and from railway managers in English colonies, who have given their reasons for preferring American locomotives with considerable freedom, and in language strong enough to suit the most ardent. The assuming and asserting of the past two years has for the most part been done abroad, and simply copied by American journals as matter of common interest.

But apart from this the assumption is very plain that American master mechanics are either ignorant of common mechanical practice (and assumed requirements) or too indifferent to adopt what is really good. Either of these assumptions shows a very complete misapprehension of facts. At the Master Mechanics' Convention of 1882 the subject of butt joints was very fully discussed. In that discussion the president gave it as his opinion that the butt-joint was not as strong as the welted joint, and it may be incidentally mentioned that it is the opinion of many who have given the matter attention for years that it is no stronger.

The late Howard Fry, whose railroad education was commenced in England, and who was always naturally prejudiced in favor of English methods, said:

"The reason for making a butt-joint, as given to me by those who use butt-joints, has always been that it prevents furrowing at the seam. * * * The double-riveted ordinary lap-joint is amply sufficient for our boilers, so far as strength is concerned. * * * But if we can prevent the furrowing action just as well by the joint suggested by the president [a welted joint], it would be very important for us to know it."

Mr. Sedgely said:

"We have engines upon our line in which our boilers have been used for twenty-five years with the welted joint, welted seams, * * * and to my knowledge we have never had to repair a boiler when the seam was welted. We have on portions of our line very bad water, and those boilers without the welt will require patching inside of three years, and will furrow completely through. * * * I look upon it as a sure cure to welt the seams."

Mr. Hayes described simple liners by the use of which furrowing was entirely prevented. It was also shown that furrowing never took place above the water line.

We have not space to quote further from this discussion at the Master Mechanics' Convention. It is a matter of record, and will convice anyone not hopelessly prejudiced, that the reason American master mechanics do not use butt-joints is because they know of cheaper and equally efficient means for getting all the advantages claimed for this costly construction.

These are facts that the editor of such a work ought to make himself acquainted with. The opinion that the advantages of the butt-joint had not been very thoroughly considered by railroad master mechanics here could surely never have come from any one conversant with American railway matters. The only "ripple" the assertion that "butt-joints are almost unknown here" will cause, will, we imagine, be in the way of a smile. It is laughably absurd to intimate that it is through ignorance of such joints that they are not used here, or that this form of joint possesses any features "puzzling to American boilermakers."

There are other particulars in which comparisons unfavorable to American boilers are made upon quite as unsubstantial grounds as the one noted. Of all these it may be

said that, before going out of the way to gratuitously attack American master mechanics and American railway practice, the editor of such a work as this should acquaint himself better with that practice, and some of the reasons for it.

Notwithstanding the unreasonable English bias of some of the editorial part of this work, we can recommend it as a valuable contribution to the subject of locomotives. It sells for the moderate price of $3.50.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(350) D. C. H., Lyndonville, Vt., writes: 1. I have a book on slide valve and link motion, by Auchincloss. Do you think the book the best I can get? *A.*—We think the work named a most excellent one. In the AMERICAN MACHINIST of August 28, I do not understand how Mr. Ropes gets the area of piston. He says: $17\times17\times.7854=226.981$ square inches. I make it 241. *A.*—There is something wrong in your figures. The area of a 17-inch piston, as per formula used, is 226.9806 inches. 3. If a valve on a locomotive has 1-32″ lead, and is squared by the lead at 8′ cut-off, will it have lead in full stroke? *A.*—If it has only 1-32″ lead at 8″ cut-off it will (with the ordinary shifting link) lack lead at full stroke. If the eccentric is set to give 1-32″ lead at full stroke it will have materially more lead at 8″ cut-off.

(351) J. R., ———, asks: In pumping water into a tank with an injector will the water delivered be hotter if the water pumped is first made as hot as the injector will work it? *A.*—Yes. 2. Will the injector deliver more gallons of water if it is previously heated? *A.*—We have no means of knowing, but should expect a little less. 3. Will it require less steam to fill the tank if the water is previously heated? *A.*—Such data as we have seen would seem to indicate that a little more steam would be required for the hot water. The difference would be trifling, and the heat would be accounted for by increase in temperature of the water delivered. 4. Having a two horse-power boiler, pressure 150 lbs., what size injector should I use, and how much water will it deliver per hour? *A.*—You do not say to what height the water is to be forced. The proper way to find this out is to ask the manufacturer of whom you propose to buy. 5. How many pounds of feed water will the boiler require per hour? *A.*—It is generally considered that about 30 lbs. of water evaporated per hour, under fairly high working pressure, should be considered a horse-power. 6. How many liters in a gallon? *A.*—3.8, very nearly.

(352) C. T., Jackson, Mich., asks: 1. What is the correct way to ascertain the energy of a steam hammer? *A.*—See Question and Answer 253, June 26, 1886. 2. What is the heat of steam at 80 lbs. and 100 lbs. pressure? *A.*—The temperature of steam at 80 lbs. (gauge) pressure is 323+ degrees; at 100 lbs., 337+ degrees. 3. What is the velocity of steam at above pressures? *A.*—Flowing into the atmosphere, probably from 1,800 to 1,900 feet per second.

(353) L. E., Pittsburgh, Pa., asks: 1. We are troubled with acid in the water fed to boiler, which causes it to foam so badly that at times we have to shut down. The acid comes from oil of vitriol from an oil refinery above us on the river. What can I do to prevent the boiler from foaming? *A.*—We do not know of anything better than frequent blowing down. Perhaps by carrying your pipe further into the river, or changing its location in some way you might get better water. You should examine your boiler internally to see if it is not being injured. 2. Is animal oil injurious to steam cylinders? *A.*—Animal oil is likely to eat away the metal around joints, and sometimes does a good deal of damage. 3. What is the acid in animal oils that causes trouble? *A.*—Fatty acids, such as stearic and oleic. 4. How can I detect the animal oils when mixed with mineral oils? *A.*—We do not know of any simple way.

(354) J. A., Buffalo, N. Y., asks: What is wire-drawing steam? Is it done between the boiler and engine, or in the cylinder? *A.*—Wire-drawing steam, in connection with a steam engine, is reducing the pressure between the boiler and cylinder. It is brought about by passages too small to permit steam to pass through sufficient to keep up the pressure behind the piston as it moves ahead. A throttling governor wire-draws the steam to regulate the speed. By partially closing the throttle valve the steam is wire-drawn.

(355) P. G., Shenandoah, Pa., asks: Has there ever been a ratchet drill invented in which the drill continues to turn ahead with the backward motion of the handle, and would there be any advantages in such a ratchet? *A.*—Our impression is that such drills have been patented. We do not think the advantages would pay for the complication.

(356) H. B., Monico, Wis., asks: 1. What power can I get from an engine 2″x2½″, 700 revolutions, 80 lbs. steam pressure? *A.*—You may get 1¼ horse-power. 2. I want to put on a link motion. How shall I get the circle and length of link? *A.*—Make the circle as if struck from the center of shaft. Make the length of link between the two points at which eccentric rods connect (for so small an engine) about four times the full throw of eccentrics. The throw of an eccentric is twice its eccentricity.

(357) B. I. W., Birmingham, Ala., writes: I have had a good deal of trouble with my crucibles cracking in the furnace. Can you tell me what will prevent this? *A.*—The first thing is to get good crucibles; the second is to temper them by gradually heating them for some days before using.

(358) W. W. K., Newark, N. J., writes: Will you please tell me how to make a solution from which soap bubbles that will last for a long time can be made? *A.*—The following is recommended by Dick: Fine shavings of palm soap are shaken in a large bottle with distilled water, until a concentrated solution is obtained. This is filtered through gray filtering paper, and then mixed with about one-third its bulk of pure glycerine. The fluid is to be shaken up before use. By means of a small glass funnel of two inches diameter, connected with a tube of india-rubber, soap bubbles may be prepared with this fluid. Bubbles of one foot diameter will keep from five to ten minutes; those two to three inches diameter will retain their form ten to twelve hours.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Patent Att'y, H. W. T. Jenner, Washington, D. C.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Metallic Pattern Letters and Figures to put on patterns for castings. Knight & Son, Seneca Falls, N.Y.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

20″, 25,″ 28″ B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

The best wire nail and tack and nail machinery. Wm. A. Sweetser, Brockton, Mass.

Rubber Belting, all sizes, 77½ per cent. regular list. All kinds of Rubber Goods at low prices. Jno. W. Buckly, 156 South street, New York.

Curtis Pressure Regulators, Curtis Return Trap. Curtis Damper Regulator. See Oct. 2, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Machinists' supplies, brass goods m'f'rs supplies, polishing materials, all kinds wire, metals, etc; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

"Lancaster's" Caloric Engines for all power and pumping purposes: one to twelve H. P.; noiseless, cheap, simple. James H. Lancaster, Consulting Engineer and Patent Agent, 187 B'way, N.Y. Patents and inventions bought, sold, solicited and worked.

"Hints to Steam Users, Engineers and Firemen." A 100-page book on care of steam boilers; just issued; containing useful rules, tables, etc; a valuable book for engineers; sent on receipt of 25 cts. in stamps. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15, Astor Place, New York.

Manufactures.

R. W. Boland, Birmingham, Ala., is erecting a new foundry, 40x145 feet.

John Leduke, of New Albany, will start a new woolen mill at Paoli, Ind.

H. McGregor is about to start a large plow factory at Mobile, Ala.

The Colorado Midland Railroad Company intend to build shops at Colorado Springs, Col.

It is rumored that a company will be formed at Chattanooga, Tenn., to build an iron furnace.

C. L. Jeffords, Jamestown, N. Y., will establish an edge-tool factory at Nashville, Tenn.

The Livermore Foundry and Machine Company, Memphis, have recently enlarged their works.

The Shenandoah Machine Company, Sharon, Pa., will build an addition to their machine shop.

Work is being begun in the shops of the Jacksonville, Tampa & Key West Railroad, at Palatka, Fla.

The Sedgewick Machine Works Company will erect new buildings to cost $11,000 at Poughkeepsie, N. Y.

R. H. Williams, Cleveland, O., is prospecting in Birmingham, Ala., with a view to starting a broom factory.

It is reported that arrangements are being made to build water-works at Goldsboro, N. C., also an ice factory.

J. Brockie, 123 Stone street, Newark, N. J., will erect a three-story, 30x60 feet brick factory at 8 Railroad Place.

A new knitting mill is to be erected at Fonda, N. Y., at a cost of $50,000, by Jas. Y. Van Antwerp and others.

The Gibney Iron Works, Mobile, Ala., have increased the capacity of their shops one-half, and have put in new machinery.

The Hastings Iron and Engine Works, Hastings, Mich., will probably be rebuilt in connection with the croquet factory.

Wm. Brasier, Eighth avenue and Nineteenth street, Brooklyn, N. Y., will erect an oil-cloth factory, 83x146 feet, two stories high.

The Delaware, Lackawanna & Western Railroad have purchased land at South Orange, N. J., upon which they will erect a round-house.

George L. Soule, Middleborough, Mass., intends erecting a factory, 100x30, for the use of any firm that will locate there.

G. Isaacs, 322 West Twenty-third street, New York, will erect a six-story factory, 66x78 feet, on Bethune street. It will cost $25,000.

Gustav L. Jaege, 510 East Eighty-fifth street, New York, will erect a six-story brick factory at 132 Mulberry street, to cost $30,000.

The Minneapolis and St. Louis Railroad will build a new boiler shop in connection with their repair shops in Minneapolis. It is to cost $7,000.

The Taylor and Bastrop Railroad Company will double the capacity of their shops at Taylor, Tex., as soon as their road is completed.

J. H. Smith, the flocks manufacturer, Palmer, Mass., is excavating for the foundation to his proposed new mill, to be constructed shortly.

W. C. Young & Co., Worcester, Mass., have just brought out a new 15-inch lathe. It has a steel lead screw six to the inch, with open and shut nut.

A two-story frame brush factory will be built on the south side of Elizabeth street, near Van Brunt street, Brooklyn, N. Y.—cost, $2,800—by John Murphy & Co., 162 Hamilton avenue.

Boorum & Pease, 26 Reade street, New York, will erect a building in Brooklyn for printing and binding books, to cost $53,000. It will be 75x163 feet, and five stories high.

Fredericka Radle, 338 West Thirty-seventh street, New York, will erect a five-story factory, to cost $20,000, on Thirty-sixth street, near Eleventh avenue.

A two-story brick factory, 25x39, corner York and Jasper streets, Philadelphia, will be built for Eldredge & Stewart, American and Diamond streets.

A convention of machinists and blacksmiths will be held in Cincinnati on the 8th of November next, for the organization of a National Machinists and Blacksmiths' Association.

The foundry and machine shop of George R. Lombard & Co., Augusta, employ 100 hands. They have recently put in new machinery, and have added largely to their capacity.

Pembroke, Dennysville and Eastport people have subscribed nearly $20,000 to purchase the Pembroke Iron Works property at Pembroke, Me., and operate a nail factory there.

Mayor Preffer, Jeffersonville, Ind., and a number of other leading citizens, are forming a company with a capital of $100,000, for the purpose of erecting and running cotton mills.

Little Falls, N. Y., with a 10,000 population, is looking about for a water supply from Beaver Creek. It is said this brook runs a stream that will average 4,000,000 gallons a day.

Beginning September 1, the pay of the employes of the Howe Scale Company, Rutland, Vt., has been raised 6 per cent. uniformly, restoring the rate paid before the last reduction made about a year ago.

The woolen mills at Jockey Hollow, Vt., owned by William Moorcroft, have been shut down for some time because of low water. They have a number of orders ahead.—*Boston Commercial Bulletin.*

The wages of the forty men employed at the Union Boiler Works of Obert & Eckert, at Reading, Pa., have been increased 10 to 15 cents a day, and they will hereafter receive $2 for a day's wages.

The Montgomery Iron Works, Montgomery, Ala., have been reorganized, with J. W. Dimmick as president, and P. B. Bibb secretary and treasurer. The company will greatly enlarge their works at once.

It is stated that Jones & Laughlins, proprietors of the American Iron Works, of Pittsburgh, have determined to put an end to the difficulty between the nailers and feeders by adopting the self-feeding nail machines.

Pattee & Draper, of the Holyoke Hydrant and Iron Company, Holyoke, Mass., are building an addition to their shops, corner of Commercial and Hampshire streets, 56x30 feet, which will be used as a foundry.

At Dayton, Tenn., a large building was recently erected for a foundry and machine shop. On the completion of the building there was some hitch in the business of stocking it with machinery, and the structure is now used as a church.

Peter Frasse & Co., 95 Fulton street, New York, have brought out a new 10-inch swing engine lathe with four-foot bed, screw-cutting, to cut from 5 to 144 threads. It is fitted with rise and fall tool block, and other approved appliances.

The officers of the Warren Tube Company, Warren, O., are: President, N. Monsarratt, of Akron; vice-president, T. W. Cornell, of Akron; treasurer, Wm. A. Palmer, of Akron; secretary; J. H. Faxon, of Elyria; general manager, Winslow Allderdice. Works are now being erected.

The architect's plans for the Moses Craft's Shoe Company building at Auburn, Me., are for a building 105x34 feet and four stories high, besides a basement. The new factory will be designed after the most approved style of shoe manufactories.—*Manufacturers' Gazette.*

Geo. S. Ayer has sold his pump factory in Saco, Me., to S. W. Duff. The pumps made at this factory are covered by several patents secured by Mr. Ayer; and F. O. Furber, successor to Furber Bros., Saco, will also manufacture these pumps on royalty. Mr. Ayer expects soon to locate a factory in Canada.

The Eaton, Cole & Burnham Company, Bridgeport, Conn., is erecting a new iron foundry in the rear of its present buildings. It will have two floors of 15,000 square feet each. It proposes erecting a new brass foundry and finishing shop where its iron foundry now stands, which will be three stories in height, 100x175 feet.

There is on an average about 12 carloads of machinery shipped daily from Orange, Mass., by the Fitchburg Railroad, six by the New Home Sewing Machine Company, four by the Rodney Hunt Machine Manufacturing Company, and two by the Chase Turbine Manufacturing Company. Business in all these shops is good for this month.

The National Cottonseed Oil and Huller Co., with $100,000 capital, has been chartered at Memphis, Tenn. The charter is signed by F. M. Maddox, of Austin, Texas, a cattle king; J. S. Zerbie and Wm. R. Fee, of Cincinnati, and J. W. Washburn, Waverly, Ohio; R. M. Ditty and R. T. Hough, Hillsboro, Ohio; and R. R. Freeman and G. W. Washburn, Chillicothe, Ohio.

The stockholders of the Westinghouse Air Brake Company held a meeting in Allegheny, Pa., September 7, and increased the capital stock from $600,000 to $3,000,000. The following officers and directors were re-elected: George Westinghouse, president; Robert Pitcairn, vice-president; John Caldwell, treasurer; W. W. Card, secretary; H. H. Westinghouse, general agent; T. W. Welsh and C. H. Jackson.

The Pratt Coal and Iron Company, Birmingham, Ala., has taken in additional capital, and will spend $1,000,000 in opening three additional mines and in erecting two new furnaces, in addition to the two previously reported, each 85 feet high, with 22 feet bosh, for manufacturing basic iron, and will also erect steel works and 1,000 more coke ovens.—*Baltimore Manufacturers' Record.*

"A Treatise on the Use of Steam in Electric Light and Power Plants" is the title of a pamphlet just issued by the Pond Engineering Company, of St. Louis. It describes engines, boilers and apparatus for electric lighting. This company has put up a large number of electric light plants in the West, to which they refer in the pamphlet.

Remington & Co., of Wilmington, Del., are about to reorganize by making their company a corporation, with a capital stock of $200,000 limit. G. W. Remington, of Remington & Co., will be president, with H. M. Taylor, now with the U. S. Electric Light Company, of New York, as secretary and treasurer and Jno. J. Satterthwait, formerly a foreman with the Pusey & Jones Company, of Wilmington, as superintendent. They expect to enlarge their works soon.

The *National Labor Tribune*, of Pittsburgh, in reviewing local industries, says in its last week's issue: "The demand for iron and steel is still increasing, but the volume cannot be brought to a much greater point. In the puddling furnace capacity probably a little more than a notch higher can be reached, and that is in changing 44 furnaces now on six heats to ten heats double turn, but it would only make the amount each day 36 tons more. Shoenberger & Co. are the only firm this week that have idle puddling furnaces. Within the last year they can be classed with the steel manufacturers, who require very little muck iron. Outside of these, the 34 furnaces in the burned Sable mill of Zug & Co. embrace all the idle puddling furnaces in our mills. The intention of the firm is to start up 12 of these this week, and by next week all of them will be on single turn, from which enough muck can be made to supply all the finishing rolls."

Machinists' Supplies and Iron.

NEW YORK, Sept. 23, 1886.

Iron—Transactions are of a quiet nature, to meet current wants of consumers. Prices remain unchanged. We quote Standard brands, No. 1 X Foundry, $18 to $18.50; No. 2 X, $17 to $17.50; Grey Forge, $16 to $16.50.

Scotch Pig—There is but little in stock, and prices are held firm at: Coltness, $20; Glengarnock, $19; Gartsherrie, $19.50; Summerlee, $19.75; Eglinton, $17.50 to $18; Langloan, $19.50.

Lead—There has been a decline in price to 4.50c. for Western.

Copper—There has been an advance in price to 11c. for Lake.

Antimony—Hallett's, 7.70c.; Cookson's, 9c.

Spelter—Refined, 5¾c. to 6c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Machinists, send address to L. S., AM. MACHINIST.

Wanted—Position by an experienced machine shop foreman; references. Address West, AM. MACH.

Mech. engineer and draftsman, competent and reliable, desires situation. Address Peta, 1,257 Garden street, Cleveland, Ohio.

Draftsman, with 10 years' practical experience, wants engagement. Address G. F., AM. MACHINIST.

An experienced draftsman and designer on steam engines and general machinery would like to change position. Address Experience, AM. MACH.

Mechanical engineer, graduated in Germany, with practical experience, wants situation as draftsman. Address Arnold, 943 S. 2d, Philadelphia, Pa.

Mech. engineer and draftsman on locomotives and steam engines, with thorough theor. education, is open for engagement. Address Engineer, AM. MACHINIST.

Wanted—A man to sell machinery on salary; none but men of experience need apply. Address, Dixie, AM. MACHINIST.

Wanted—Position as foreman, by an experienced boiler shop foreman. Address Foreman, AM. MACHINIST.

We want a representative in every large manufacturing town in the U. S. for "Queen Lubricant;" used and indorsed by largest iron works. Eureka Mfg. Co., foot East 26th st., N. Y.

A machine foreman, with 5 years' experience in managing men and shop manufacturing small tools, special and interchangeable machinery, seeks like position; first-class reference. Address "Engineer," Box 45, Ridley Park, Pa.

Wanted at once—A thorough machinist—practical, intelligent and temperate young man—to take charge of a shop where heavy tools are a specialty; location within 50 miles of Philadelphia. Address Enterprise, AM. MACHINIST.

Wanted—A good foreman for a foundry in a near-by city; none but those thoroughly conversant with the business in all its branches, and stating wages and references, need apply. Address Foundry, AM. MACHINIST.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent Boiler Tube Expander; second to none, price in reach of all. Crescent Mfg. Co., Cleveland, O.

The Crescent Link Belt Coupling; something new; sample free. Crescent Mfg. Co., Cleveland, O.

Wanted—A two or three H. P. steam boiler, new or second-hand. Albert Baker, Westfield, Pa.

Steel stamps, stencils, burning brands, and brass checks. T. M. Parker, Hartford, Conn.

Light mach'y of all kinds built at short notice. Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

For Sale—Small machine shop and foundry; well located; full or half interest. S. & H., AM. MACH.

Xperimental work for inventors; fine work; low price. LeRoy & Sharpe, 96 1st st., Br'kl'n, E. D., N. Y.

For Sale—Whitcomb planer, 8'×27"×27", good as new, one 10' lathe 18" swing; planer patterns for 6'×24"×24', and special tools. Woodman & Weare, Laconia, N. H.

Machinery—Sept. list sent on application; new & 2d-hand engines, lathes, planers, shapers, drills. C. L. Jackson & Co., Mach'ry, Tools & Supplies, Balto., Md.

The best engines and boilers, ½ to 4 H.P.; economical in price, steam, etc. Washburn Engine Co., Medina, Ohio.

John Lamberty, mfr. telegraph and electrical instruments, experimental machs, models; fine gear cutting a specialty. 35 S. 5th st., Br'kl'n, E. D., N. Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

Experimental and new machinery for special purposes built by contract from specifications and inventors' designs; ample facilities. Cohoes Iron Foundry and Machine Co., Cohoes, N. Y.

Wanted—A first-class cotton and woolen shuttle maker as partner; a good opportunity for a man (who understands the business) with a small capital. Address Box 4, AM. MACHINIST.

For Sale—A well established foundry and machine shop, including lots, buildings, machinery, patterns, and stock on hand, situated in Logan, Hocking Co., Ohio; will sell on easy and satisfactory terms; reason for selling—old age and ill health. Apply to R. Belt, Logan, Ohio.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Send for estimates of high-speed compound enginss for stationary and marine service. Crist Engine Works, 140 Baxter street, N. Y.

For Sale—The machinery, tools, plating apparatus and raw material of manufacturing establishment; now working on orders in brass and other metals; very low rent, including steam power. Address Manfr., P.O. Box, 285, New Brunswick, N.J.

For Sale—A first-class foundry and machine shop; large connection in saw-mill county in the South, including buildings, lots, machinery, and mills' supply stock on hand; business will be carried on until sold; reason for selling, retiring from business; apply at or address Southern Foundry, AM. MACHINIST.

"Lancaster's" Caloric Engines for all power and pumping purposes; one to twelve H. P.; noiseless, cheap, simple. James H. Lancaster, Consulting Engineer and Patent Agent, 187 B'way, N.Y. Patents and Inventions bought, sold, solicited and worked.

For Sale—The best-appointed and best-located machine shops in the Northwest—the plant and shops of the St. Paul, Minnesota, Harvester Works; to be sold on sealed bids, Oct. 15th. Pamphlets, containing maps, description and terms, sent to any address, on application to Lyman D. Hodge, assignee, No. 47 Gilfillan Block, St. Paul, Minn.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

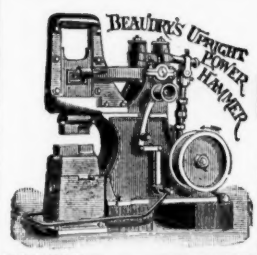
BRADLEY & CO. Syracuse, N.Y.

Business Opportunity.

TO LEASE or FOR SALE. Machine shop and foundry paying large profits. Shops Leadville, Colo. Address,

A. FALKENAU,
Care of DICKSON MFG. CO.
SCRANTON, PA.

BEAUDRY'S UPRIGHT CUSHIONED POWER HAMMER



The success of our Machine is the best guarantee of its value. Only machine with Double Helve. Does more and better work with less repairs than any other.

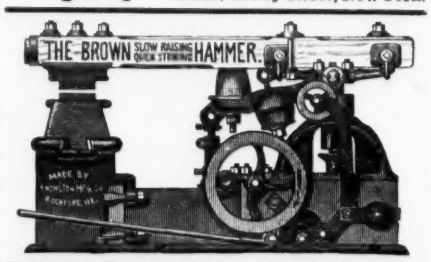
BEAUDRY & CUNNINGHAM, Boston, Mass.

STEPHENS PATENT VISES.

50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the Improved Taper Pipe and other attachments. Sold by the trade. Send for circular

MELVIN STEPHENS, Prop'r.
Office, 41 Dey Street, New York.

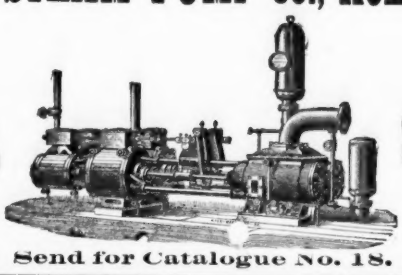
THE BROWN HAMMER



STRIKES A BLOW WITH
Double the Velocity That it Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION
Knowlton Mfg. Co., King St., Rockford, Ill.

THE DEANE STEAM PUMP CO., HOLYOKE, MASS.

BUILD WATER WORKS, ENGINES AND STEAM PUMPING MACHINERY.



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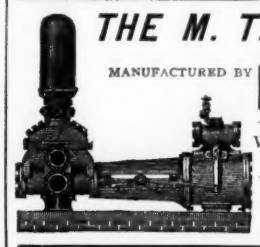
THE M. T. DAVIDSON IMPROVED STEAM PUMP,



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WARRANTED THE BEST PUMP MADE FOR ALL SITUATIONS.

PRINCIPAL OFFICE, No. 77 LIBERTY STREET, N. Y.
NEW ENGLAND OFFICE, 51 OLIVER STREET, BOSTON, MASS.

THE HENDEY MACHINE COMPANY. MANUFACTURERS OF TORRINGTON, CT. Machinists' Tools, LATHES, PLANERS, SHAPERS, DRILLS, ETC., ETC. *SEND FOR CATALOGUE*

H.W. JOHNS' PATENT ASBESTOS ROOFING

THIS ROOFING is the perfected form of portable Roofing, manufactured by us for the past twenty-seven years, and is now in use upon roofs of Factories, Foundries, Warehouses, Cotton Gins, Chemical Works, Railroad Bridges, Cars, Steamboat Decks, etc., in all parts of the world.

It is supplied ready for use, in roll containing 200 square feet, and weighs with Asbestos Roof Coatings to finish, only about 85 pounds to 100 square feet.

It is adapted for all climates and can be applied readily by unskilled workmen.

Samples and Descriptive Price Lists free by mail.

H. W. JOHNS MANUFACTURING COMPANY,
SOLE MANUFACTURERS OF
Asbestos Fire and Water Proof Building Felt, Steam Packings, Boiler Coverings, Liquid Paints, Fire Proof Paints, Colors in Oil, Varnishes, etc.,
87 MAIDEN LANE, NEW YORK.
175 RANDOLPH ST., CHICAGO. 170 NORTH 4TH ST., PHILADELPHIA. BILLITER HOUSE, LONDON.

WHY THIS IS PUT HERE!

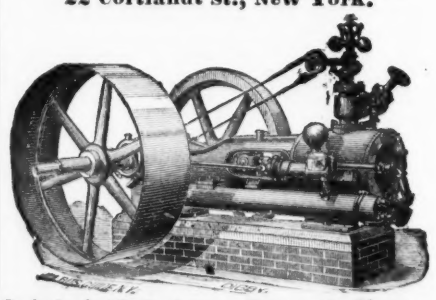
For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the **NEW PULSOMETER,**

THE CHEAPEST AND BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.
More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.
Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A-1 Testimonials. Mailed Free.
PULSOMETER STEAM PUMP CO., 83 JOHN STREET, N. Y.

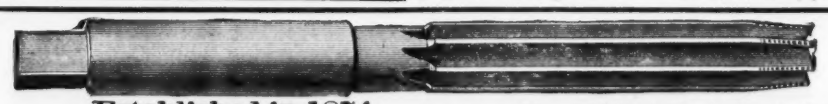
WHITE'S FLEXIBLE METALLIC FILLET
For use of Pattern Makers. Sizes 1 4 to 1 in.
HOWARD WHITE, 44 N. 4th ST., PHILA PA.
Send for Circular & Samples

GUILD & GARRISON,
BROOKLYN, N. Y.
STEAM PUMPS,
VACUUM PUMPS,
AIR COMPRESSORS.
SEND FOR CATALOGUE.

IF YOU WANT A STRONG, ECONOMICAL
ENGINE,
Either *Horizontal* or *Vertical*,
For steady every-day and all-night service, and at a *Low Price*, write to
COOKE & CO.,
22 Cortlandt St., New York.



Twelve hundred Engines in use Please mention this paper.



Established in 1874.
CLEVELAND TWIST DRILL CO.
24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

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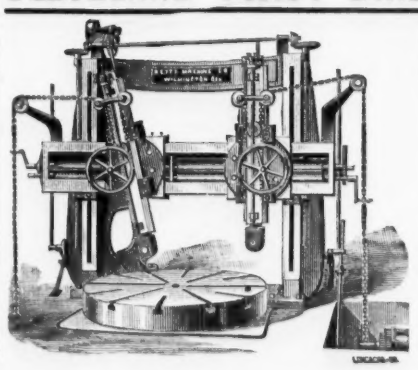

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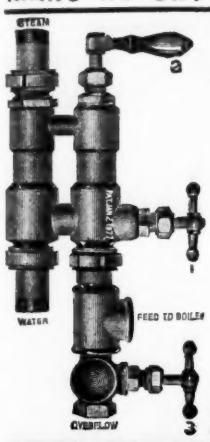

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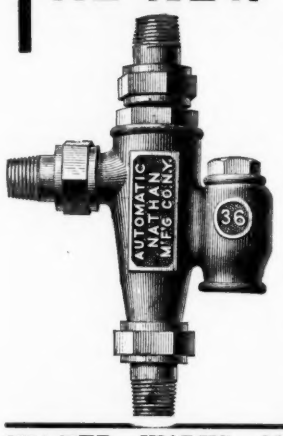

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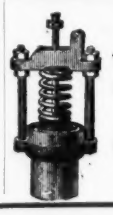

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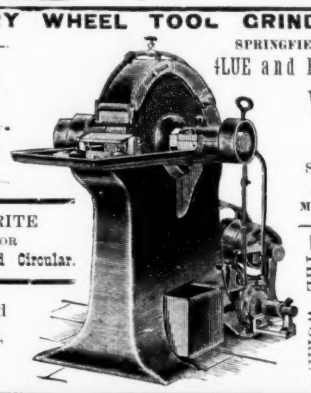

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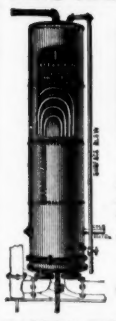

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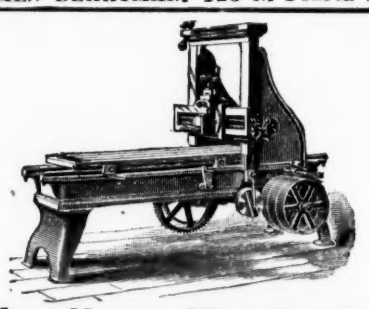

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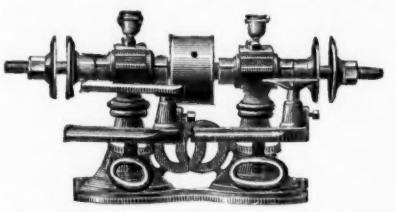

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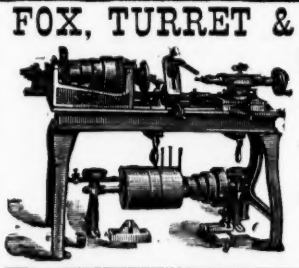

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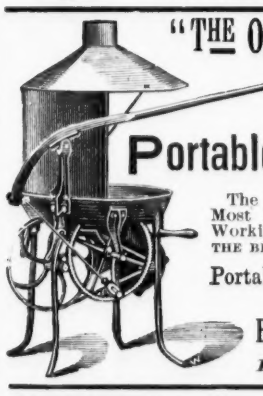

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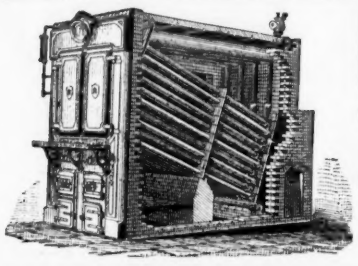

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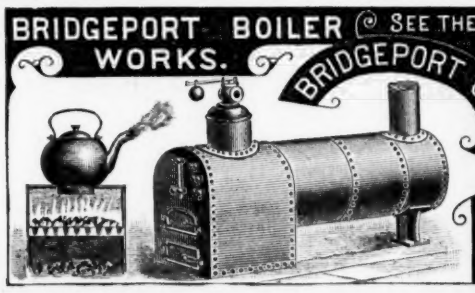

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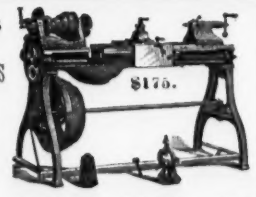

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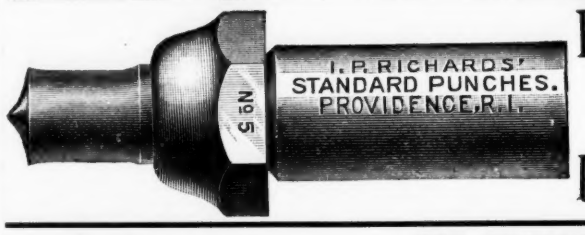

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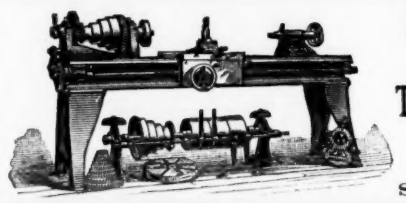

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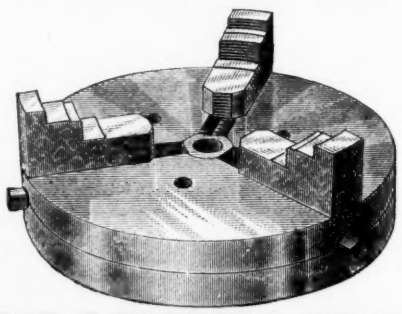

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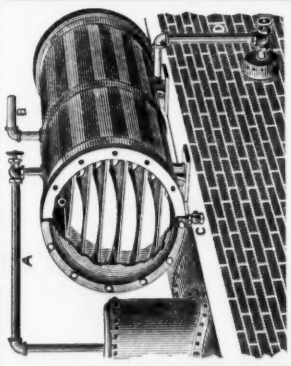

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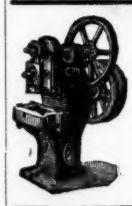

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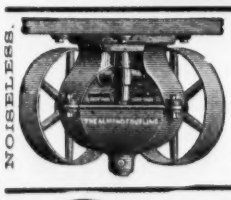

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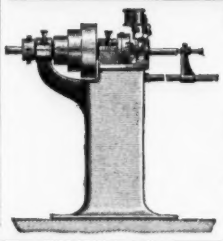

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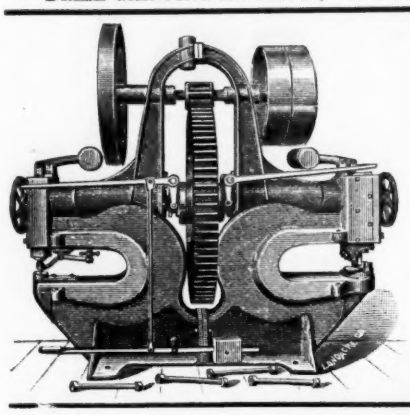

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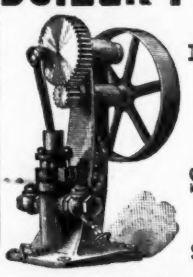

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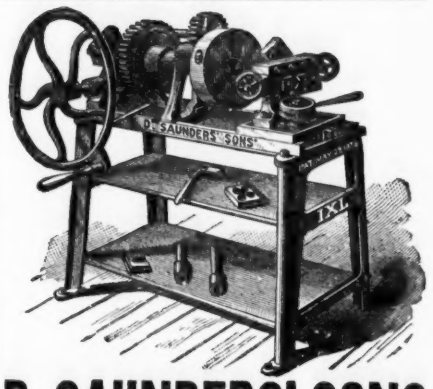

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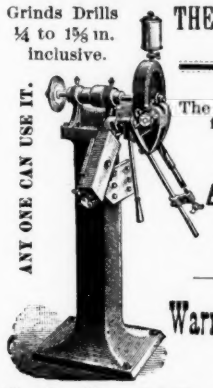

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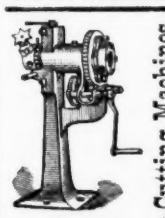

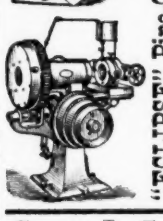

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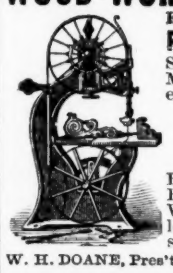

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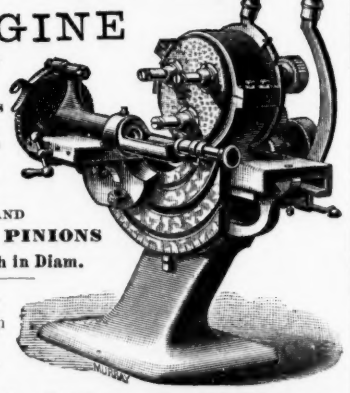

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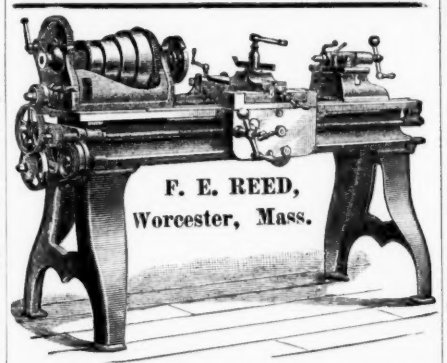

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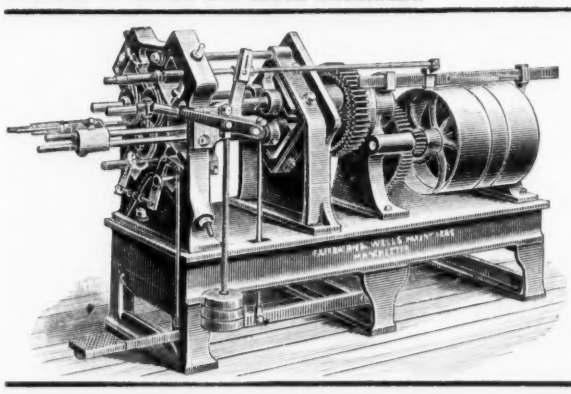

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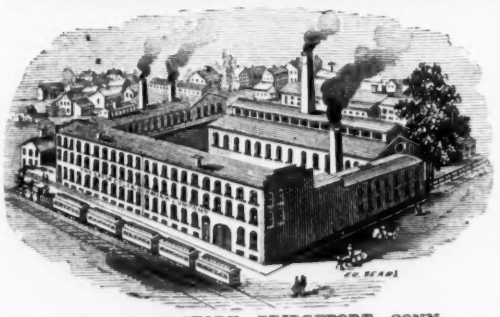

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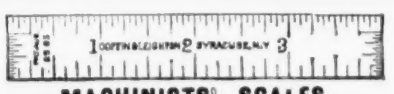

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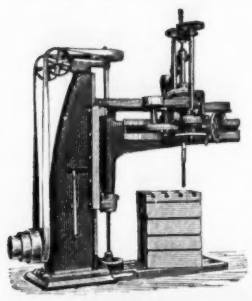

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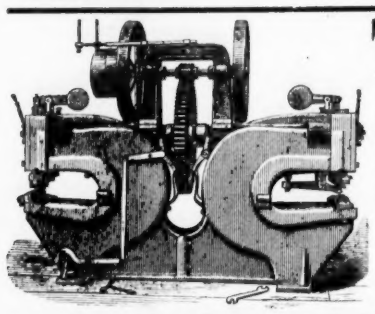

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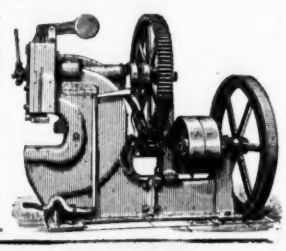

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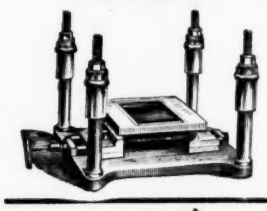

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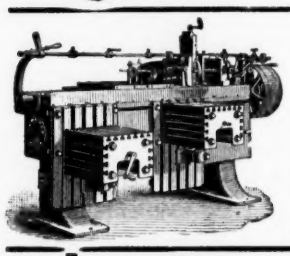

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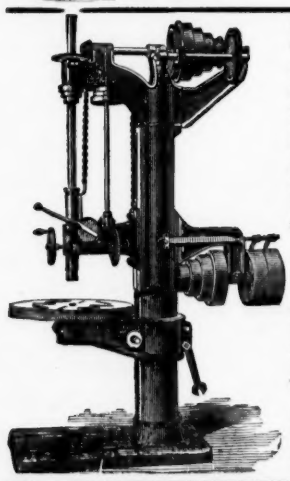

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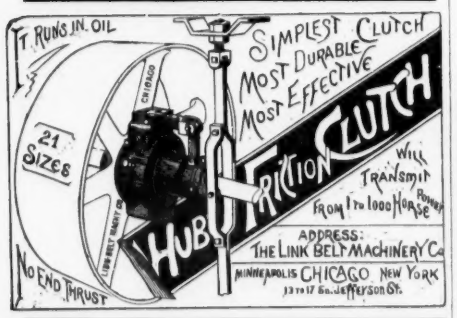

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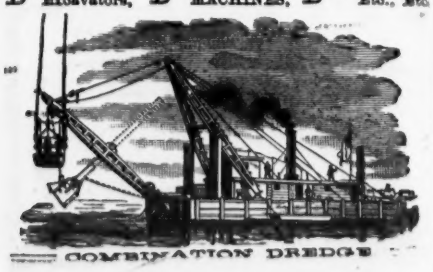

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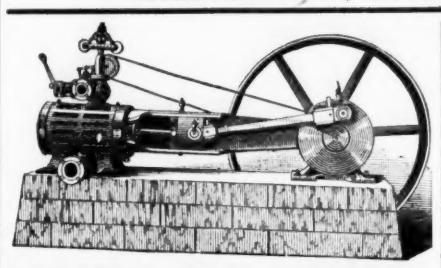

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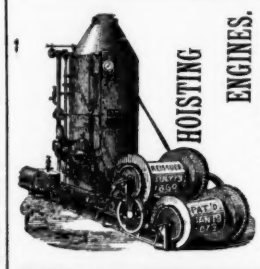

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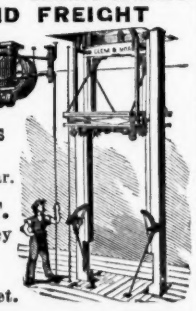

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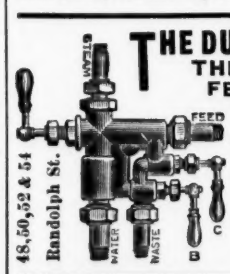

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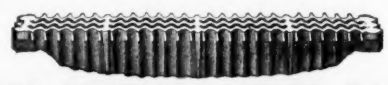

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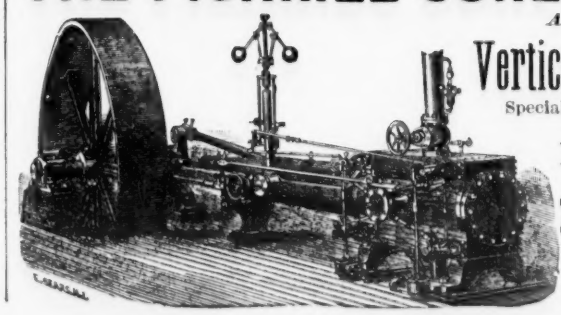

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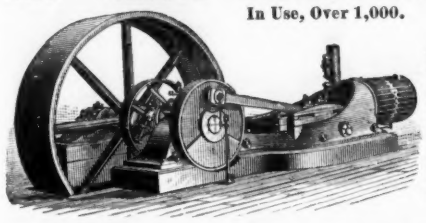

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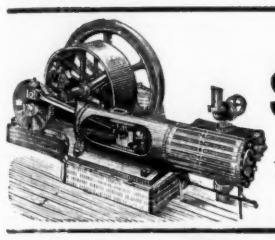

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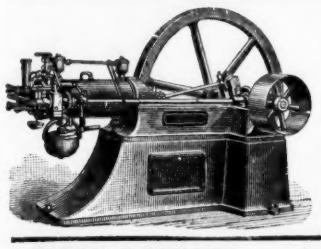

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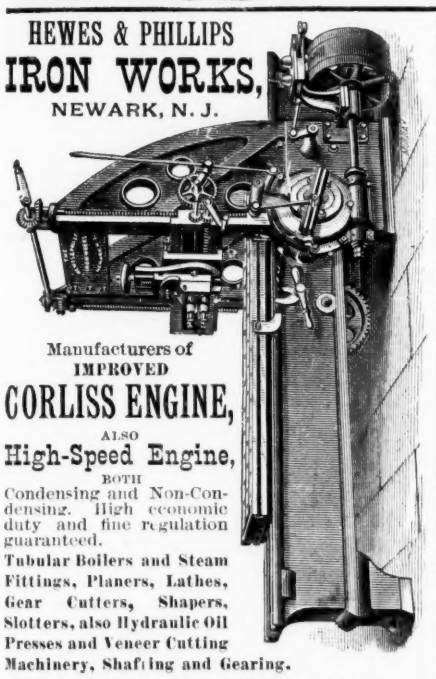

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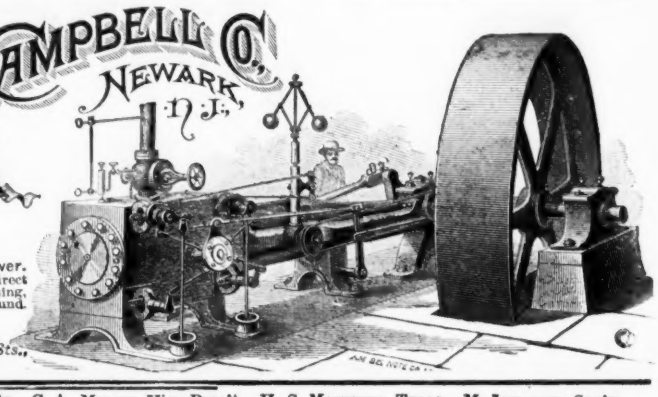

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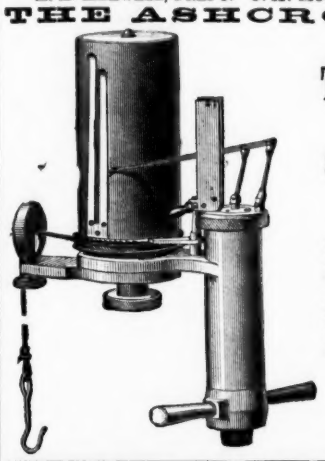

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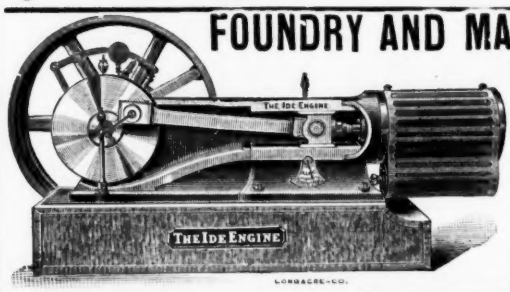

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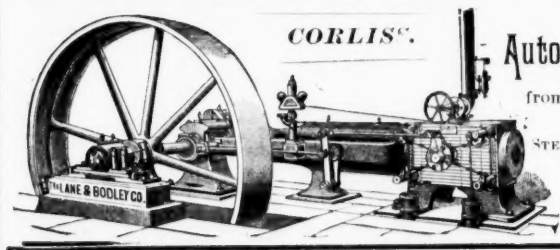

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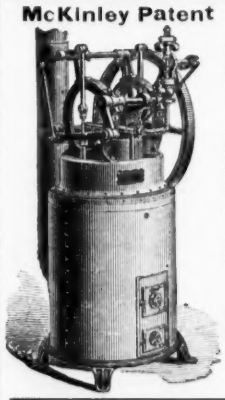

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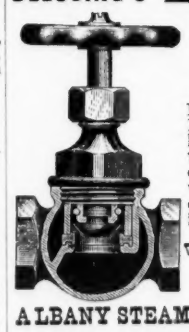

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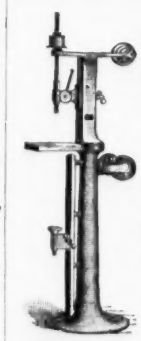

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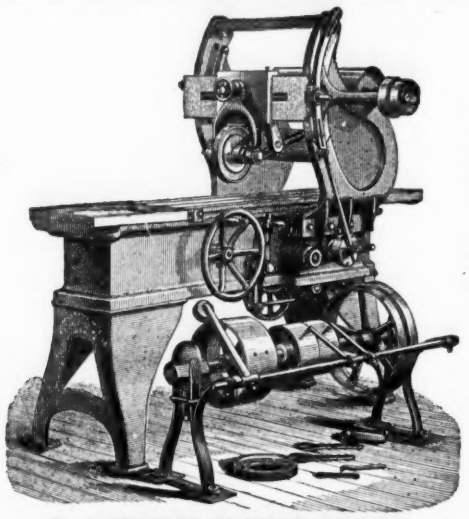

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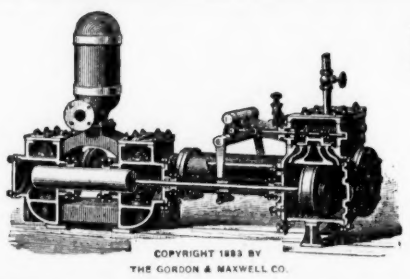

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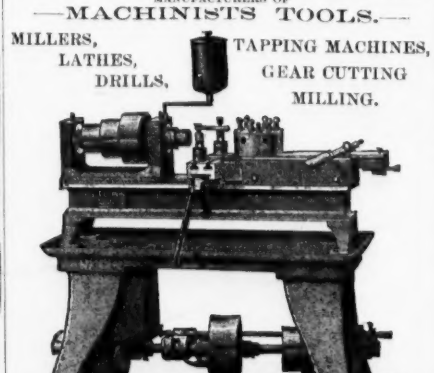

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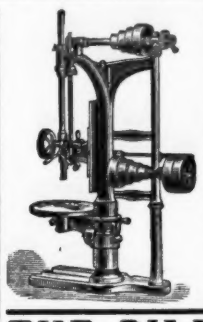

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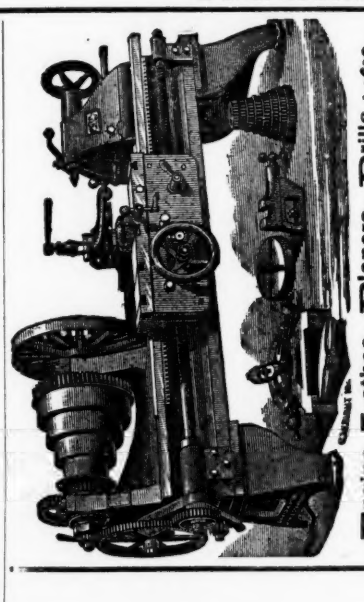

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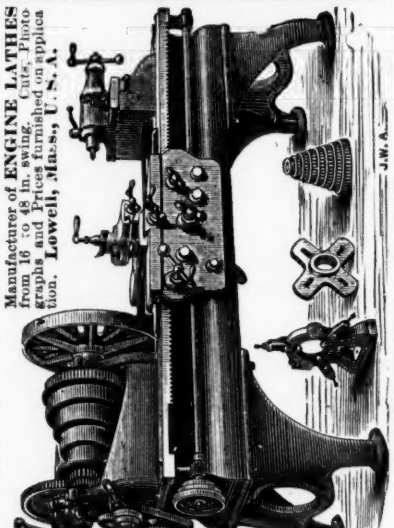

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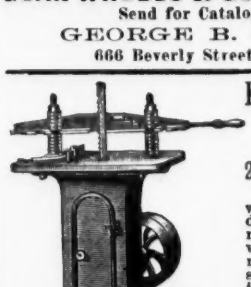

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